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A Modern Apprenticeship

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Attempting to revive the old tradition of apprenticeship—How the boy, the high-school graduate and the technical graduate are handled—Industry and community co-operate

CAN apprenticeship training be revived in American industry? Can young Americans be induced to take up a formal course of shop training in the various metal trades? Can a modern American manufacturing plant make itself industrially independent and self-sufficient if the influx of skilled metal workers from Europe be cut off? Can, in short, a formal apprenticeship be made economically successful under present-day conditions?

These and many other questions confronted the executive heads of The Falk Corporation some years ago when they determined upon an attempt to revive a system of apprenticeship that would supply their personnel organization with an adequate number of skilled craftsmen in every department. Their varied manufacturing business required skilled mechanics in all departments and their organization, like many others, felt the effects of the post-war European conditions and a restricted immigration policy on the part of our own government. But a formal apprenticeship was determined upon as the only solution of the problem.

The organization had unquestionable advantages that could be capitalized in such an enterprise. The existing shop personnel, at least in the executive department, was for the most part a product of the old apprenticeship scheme as carried on either in Europe or as continued in isolated localities as a part of the European tradition in this country. Practically without exception, every foreman and shop superintendent had had in his youth an apprenticeship training. There was no question of the immense value of these living examples of the apprenticeship tradition as they were to be found in every department.

When, therefore, the executives determined upon the establishment of an apprenticeship organization they were merely recognizing the changed conditions in the manufacturing world. They realized that the foremen and shop superintendents must be made the chief factor in the training of their apprentices while the apprenticeship organization itself was merely to relieve the foremen of the burden of detail in carrying on a full-fledged and adequate apprenticeship.

An apprenticeship organization was formed to put into effect the ideas and ideals of apprenticeship as they existed in the present organization. *But*—not only was order to be established within the organization itself, the rules of the game laid down, and the burden of petty detail lifted from the shoulders of the foremen, new contacts had to be made in the outside world. Apprenticeship was not merely a matter of training young men but first and foremost a matter of attracting them. And while under other conditions this would automatically care for itself, it was not forgotten that the tradition of apprenticeship was for all practical purposes extinct in almost every class of society. Parents, teachers, and pupils must have their attention called to its value, the place it should rightly occupy and the benefits to all.

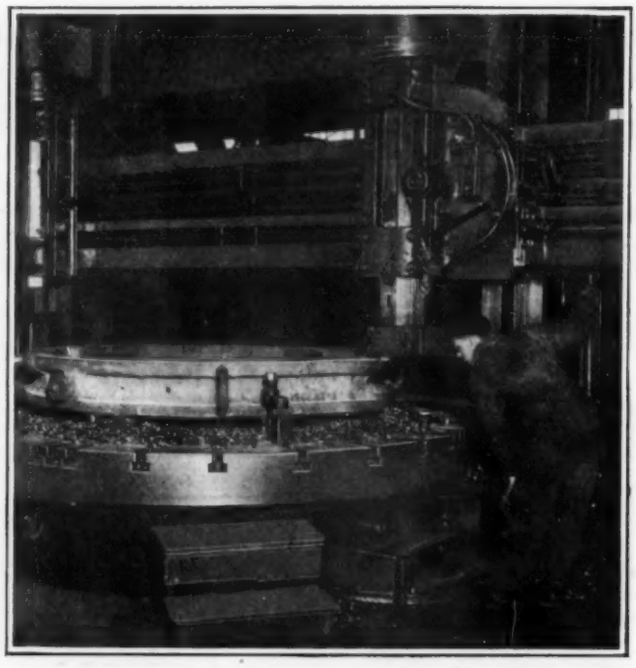
Nor was this all. It was immediately felt that no modern manufacturing organization could stand alone and make successful a scheme of industrial education such as was contemplated. Neighboring plants had carried on apprenticeship and would undoubtedly have much that would be of value. Again there were phases of its own work that were not represented in the various departments. Some form of co-operation with other organizations must be established in order to present and justify a full and adequate apprenticeship training plan.

The old relationship between the employer and the apprentices must be re-established. The modern foremen had been mainly concerned with production. Little

or no time remained to carry on the personnel work so essential in an apprenticeship scheme. The old days when the employer was everything from the "old man" to a "worker" had long since passed. The days when he mingled with his men and particularly with his apprentices, took an interest in their training and watched over their development as a father might, had become history. Some form of personal representation of the employer before his apprentices must again be revived.

Last of all, apprenticeship again must be made a real education in industry.

Such thoughts were the meat of the discussion in the days immediately following the war, when it became obvious that apprenticeship was necessary to the continued existence of American industry. It is significant that the first essential, though not the most important one, was the establishment of an apprenticeship organization.



If apprenticeship were to be made an education, obviously courses in both the shop and class room had to be established. And while this was one of the first things to be done, it was immediately realized that such courses or schedules could not and should not be made wooden and inelastic.

In the course of time five distinct classifications of apprentices and apprentice training programs in each department were developed. The regular apprentice, usually the lad of sixteen (in the State of Wisconsin, the legal minimum apprenticeable age) was to make up in major part the apprentice group in the machine shop, foundry, patternshop, and power plant. But the high-school lad must also be accommodated. Considerable good material could undoubtedly be drawn from young men who had had a high-school education or its equivalent. While it has been commonly supposed that American young men are either all rushing into white-collared jobs or into a higher education, it was soon discovered that this was not nearly so general as supposed. Subsequent events proved the wisdom of drawing up courses for this class of American youth.

University graduates of technical or allied courses, though necessarily small in number, relatively, have a distinct place in a training system of this kind. Though, of course, they seldom have a trade in view such training is beneficial both to themselves and to the company which can later on make use of technically trained men in sales, design and general executive positions. Two-year shop training courses were established for this class of prospective apprentices. The courses for the highschool and grade-school lads were made three and four years respectively, based on the somewhat general tradition that four years of school work should be credited as about equal to one year of shop training. While this is not always a sound tradition so far as the results are concerned, yet it offers a general basis for classification.

Co-operative engineering apprentices were likewise to be considered in this scheme of industrial education. Marquette University had established, immediately following the war, co-operative engineering courses, five years in length, based generally on the Cincinnati plan which has made its founder, Dean Schneider, justly famous. Milwaukee offered excellent opportunities for an engineering course of this kind. The co-operative engineering student attends university classes full time during his freshman year. For the remaining four years he spends alternate months in some suitable Milwaukee industry with which the school authorities have evolved a satisfactory course of engineering apprentice training.

The Falk organization has made the Marquette University Co-ops an essential part of its apprentice personnel. The course for these young men includes work in the machine shop, foundry, pattern shop, drafting room and power plant in such proportion as would seem best to fit them in their two years of actual shop training, not so much as mechanics but as candidates for sales, designing, and executive positions. Their shop work is as important as their school work in the eyes of the school authorities. The co-operation of the latter with the industries is based upon this understanding.

The various schedules of shop work cover all phases of the respective trades. A machine shop apprentice gets some training in the fundamentals of metallurgy and heat treatment. Likewise in the foundry. A thoroughly trained foundryman or molder should know the origin of the materials he is dealing with, their manufacture, use and various adaptations. In general it may be said that while the idea of an efficient trade training is kept in mind as much of the allied subjects so essential to a thorough understanding of trade practice is included in the course of training as possible. The attempt has been made to maintain this ideal in all the departments though of course the fundamental one of training mechanics is never lost sight of.

Parallel to the course of shop training runs the course in the related trade training given as a part of formal class room instruction. Wisconsin apprenticeship legally requires that a half day each week be devoted to class room instruction in related trade subjects. This represents the minimum. It has been found advantageous to enlarge upon it considerably. The apprentice training scheme of The Falk Corporation comprises a certain amount of full-time instruction in the local vocational school. Applicants for the various apprenticeships are sent to this institution, supported by public money, full time during at least a portion of their probationary period. There is no thought in this scheme of training for trade purposes only. During

the customary probationary period of three months, an attempt is made to guide the young applicant into that trade for which he is best adapted. Vocational guidance work can best be accomplished and with a minimum of friction in this manner. Moreover, the turnover during the probationary period is thus made to take place outside the shop. The vexations and inconveniences incident to the trial period are taken from the foremen. The whole apprenticeship scheme has thus a much better opportunity of establishing itself in the shop organization.

The apprentice, after he has passed through his probationary period, maintains his part-time contract with the school during which he is given instruction in related trade subjects only. Such part-time instruction has not only been found beneficial but necessary under modern conditions. As the small manufacturing organization is incapable of providing it, a public institution such as Wisconsin has set up in its excellent system of vocational schools is necessary.

Some form of instruction of a formal class room nature has been incorporated in the courses for high school, university-graduate and co-operative engineering apprentices.

The part-time trade instruction thus far outlined has been made obligatory for all apprentices and is given on company time. Modern trades are so intimately concerned with the immense technical development that has taken place during the last quarter century that it is impossible to give an apprentice an opportunity to become acquainted with such necessary trade and technical information during the time set aside for that work and therefore all apprentices are urged to take up correspondence and night school instruction. In addition complete preparatory advanced and technical courses have been arranged for with the local vocational school. While such related study has not been made obligatory practically 100 per cent enrollment is obtained. In other words, young American boys are anxious and ready to equip themselves for all industrial purposes.

Good Work Should Be Rewarded

Recognition for meritorious work among apprentices should be a part of an apprentice program. Grades are given in both shop and school work. In the shop the apprentice is rated daily according to the quality of shop work, his general conduct, and his attendance and punctuality. With these are incorporated ratings for school work sent in monthly by the school authorities. The apprentice organization has as its daily duty the interviewing of foremen and shop instructors as to the quality of work of each apprentice for the previous day.

The grades are made the basis of a system of awards that have been set up for the apprentices in each department. Apprentices holding the three highest grades at the end of the year are eligible to receive a substantial reward. Apprentices compete only within their own groups for separate awards in each department, excepting in the case of the general plant award to which all apprentices, regardless of their classification, length of service, or term of contract are eligible. In general it may be said that such grading and awarding will bring forth the very best efforts of each apprentice. Whether or not this is actually true is perhaps of minor importance. The results thus far obtained have justified its continuation.

While not all shop work is done under actual instruction every department has its apprentice instructor. The apprentice maintains contact with the instruction department, which is divorced from the business of production, throughout his apprenticeship. When the apprentice is transferred to the direct supervision of the foreman the latter is wholly responsible for his work, instruction and progress. Alternate periods, however, are given over to definite instruction under the shop instructor. Thus at no time is the strictly instructional phase of apprenticeship lost sight of. And this is essential if apprenticeship is to be made a real education in industry.

No Lack of Applicants

"But how can I get apprentices?" is the question usually asked by manufacturers even after they are convinced of a necessity of some form of training. So firmly entrenched is the conviction that young America will not be led into the trades that after all has been said and done there remains the idea that in spite of elaborate courses of training and supervisory organization applicants will not be forthcoming.

One of the very first essentials, obviously, if we contemplate teaching somebody is to have something to teach. And it has been found by experience that once a bona fide course of training has been inaugurated a sufficient number of applicants will appear. It is true of course that the tradition of apprenticeship has been to a large extent lost among the present generation of working families. To make an apprenticeship entirely and completely successful not only in the individual plant but in the industrial community itself this tradition must be revived.

With this in mind a program of general apprenticeship propaganda in Milwaukee was determined upon. Favorable relations were established with the school system through vocational guidance departments. This was effected by concerted action of the local metal trades organization co-operating with various civic and educational bodies.

Parents are made a very vital and important element in this training program. A monthly record of the progress of their boys' work is sent them. They are interviewed whenever the occasion demands, particularly at the time of the signing of the apprenticeship contract. They are invited to attend the program of inspirational meetings that have been conducted under the auspices of the local metal trades, and towards which all plants have co-operated.

From what has been said it is apparent that this program of training is not so much concerned with the individual plant as with the group of plants making up the metal trades industry. There was a time perhaps when the individual plant could carry on its own apprenticeship work, but that time has passed. The vast majority of manufacturing plants at the present day are too specialized in their product and operations to justify a complete course of training within their own organization. Moreover, apprenticeship is a community affair in so far as it concerns keeping a reasonable quota of mechanics for its industrial independence, and in so far as it should be the just burden of every plant to carry on its proportional share of such training work.

Apprentices are interchanged with other plants in order to present a complete and adequate schedule of apprentice training. The smaller plant co-operates with the larger. This may mean but a period of six months.

The smaller plant would not be justified in representing itself as capable of instructing an apprentice for a longer period. The remaining term of the contract can be fulfilled by the larger co-operating plant. A district supervisor has been appointed for the Milwaukee district to promote and carry on just this phase of modern apprenticeship. Interchange of apprentices is not new. It has been sufficiently tried to warrant the statement that it is the only possible means of giving the smaller organization an opportunity to bear its share of the burden.

Have the results justified the program? Apprentices have increased in all metal trades departments from several hundred to almost a thousand during the last three or four years. In the Falk organization as well as in many others a sufficient number of applicants for all the trades, including the foundry, have been found. There is no question but that a formal and supervised system of apprentice training not only in the individual plant but in the community as a whole is not only necessary but economically efficient and entirely satisfactory. This does not mean that all the difficulties have been overcome. It took a century or more to allow the tradition of apprenticeship to decay. It will take more than a few years to revive it again. But that it can be done there is no question. The truth lies in these results.

Book Reviews

Franklin Standardized-Service Handbook. 58 pages, 6¾x9¾ in. Published by the Franklin Automobile Co., Syracuse, N. Y.

This book typifies the change that has come over the selling end of the automobile industry, for service belongs to sales rather than to manufacture. As the foreword points out—"Franklin standardized service applies to automobile maintenance the same scientific control of processes which has been responsible for the economy and productiveness of American manufacturing methods." The handbook is divided into six parts: service fundamentals; standardization of service; how the system works; the paper work required; accounting, and an efficiency tool list. There are also 21 illustrations that include standardized work benches, parts racks, inventory cards, time cards, time study sheets and convenient blanks of all kinds.

The different phases of automobile repair are frankly discussed, including the disassembling of cars, handling of materials, wages, piece prices and bonus. The flat rate method is advocated, but as one factor rather than as the whole system. The statement that "no two jobs are ever alike in a service station" is modernized into "no two jobs are ever performed alike under like conditions in a service station." So, before prices or costs could be standardized, it was necessary to standardize processes, materials and tools used.

The Franklin Co. first made standard layouts of different repairs jobs. This established standard methods and managerial control. Flat prices came easily as a natural result, and setting them was comparatively simple. Labor was divided into five classifications according to skill. Excise tax, charge for tools and equipment can be set; and "extras," that bugbear to the customer, is avoided. Charges are fixed, the dealer's profit depends on the efficiency of his shop.

The book is full of practical suggestions as to eliminating unnecessary paper work and the keeping of accounts so as to know costs immediately instead of after it is too late. It points out the mistake of trying to make an old car 100 per cent perfect when 90 per cent will probably be just as satisfactory to the owner and cost much less. If Franklin service stations will faithfully follow the advice given in this handbook, they will place themselves on a high plane and eliminate most of the criticism to which service stations have been subjected in the past.

Pocketbook for Production Engineers. Second German Edition. By A. Stauch and a staff of specialists from the German Academical Society "Hutte." 1325 pages, 5x7½ in. Cloth boards. 1,440 illustrations. Published by Ernst & Sohn, Wilhelmstrasse 90, Berlin W 66, Germany. Price $5.

This handbook, which recently appeared in Germany in its second edition, and is known there under the name "Betriebs-Hutte," is intended to supply the practicing mechanical engineer with a reference work, which will enable him to quickly acquaint himself with the most important subjects in the field of production engineering.

The scope of this work will be best understood from the enumeration of a few of its 27 sections.

Materials of engineering and their testing. Mechanism. Standards of the German Industry. Plant construction. Plant organization. Time analysis. Test of personnel, and vocational education. Social politics. Foundry work. Welding and soldering. Press and forge work. Hardening and annealing. Layout work. Metal turning. Pneumatic and electric tools. Jigs and fixtures. Machine tools. Woodworking machines. Dynamic balancing.

The handbook may be recommended to those of the German-reading American engineers and technical students who would like to familiarize themselves with the way production problems are met overseas.

Mechanics of Textile Machinery. By William A. Hanton, M. Sc. Tech. Lecturer in Textile Engineering in the College of Technology and in the University of Manchester, England.—Two hundred thirty-six 5 x 8½-in. pages, illustrated with drawings and diagrams. Cloth covers. Published by Longmans, Green & Co., 55 Fifth Ave., New York City. Price $4.20.

The many problems of mechanics entering into the construction and maintainance of textile machinery are discussed in a very able manner. Beginning with details of simple mechanical movements the student is carried along by easy stages to the more complicated and difficult mechanisms applicable to such machinery.

Chapters on transmission of motion, velocity and acceleration, and balancing of moving parts, lead into the application of the principles to flyer and ring-frame winding machines, spinning machinery, looms, etc. A chapter is devoted to the application of power to the driving of the various types of machines. An appendix of 12 pages answers many questions that may arise in the mind of the reader by giving practical solutions for specific problems.

The text is distinctly English in its diction and use of technical terms, but the language of engineering is so nearly universal that no difficulty need be experienced. The book should be of great value to the engineer whose work is in connection with textile machinery.

Automotive Production

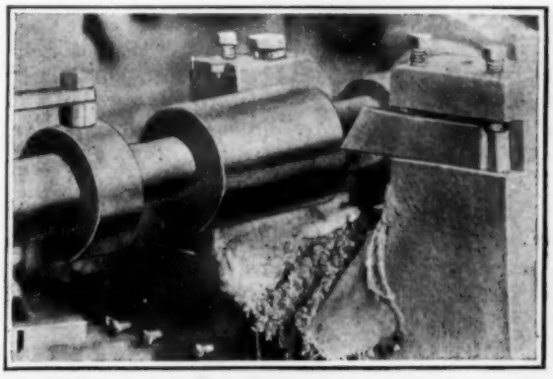
Making Pistons for Many Cars

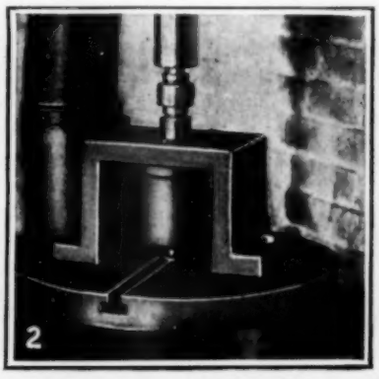
By L. S. Vadner
Superintendent, The Dyer Co.

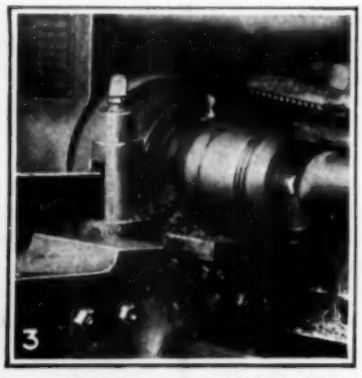
Methods that utilize standard machines, since the large variety of pistons made prevents highly specialized equipment being used to advantage — Many semi-finished pistons furnished

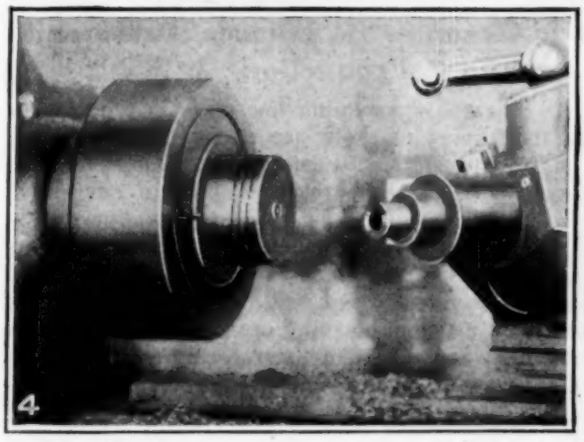
MAKING pistons for one or two cars, as is usually the case in an automobile-manufacturing plant, presents an entirely different problem than that which faces the maker of pistons for nearly all makes and models of cars now in existence. In the former case, highly specialized machinery can be used which is particularly adapted for the work to be done. Where, however, the pistons being made are for over 900 sizes and models, standard machines must be used, and at the same time high production must be secured. The illustrations show how the Dyer Company, Cambridge, Mass., is now making replacement pistons, the average run being less than 100 of any one kind.

Piston castings are made with both dry- and green-sand cores. When the castings are received, they are first heat-treated by placing from 300 to 400 in a furnace, the pistons being packed in three tiers with a ½-in. steel plate over the top to prevent the direct flame from coming in contact with them. The furnace temperature is about 1,350 F., and the heat is applied









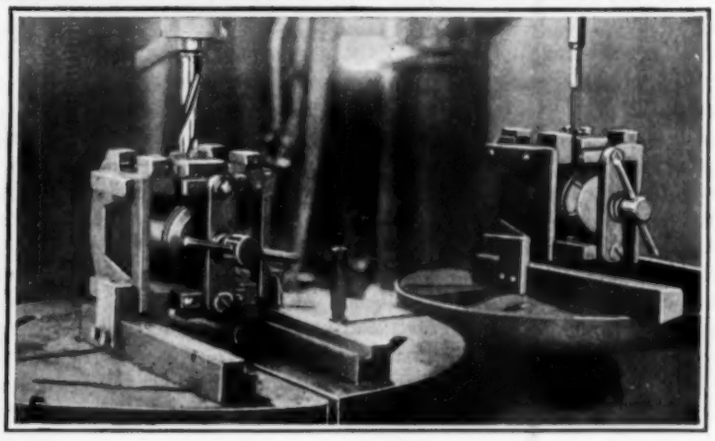
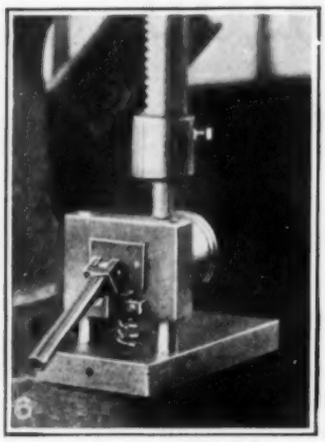
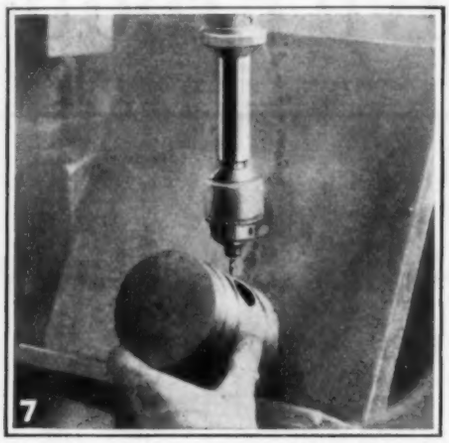


Fig. 1—Boring and facing open end. Fig. 2—Reaming open end. Fig. 3—Turning and grooving piston. Fig 4—Cutting off the center projection. Fig. 5—Drilling and reaming cross-hole

AUTOMOTIVE PRODUCTION





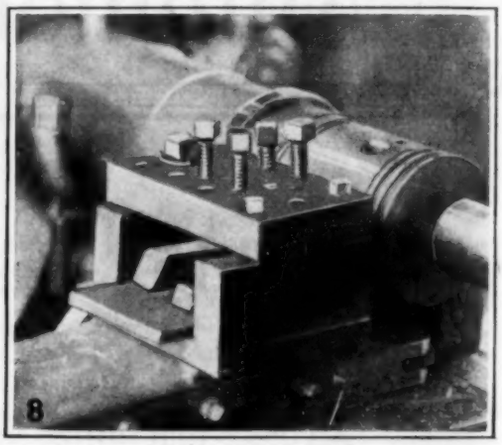


Fig. 6—Forcing in the bushings. Fig. 7—Drilling holes in scraper-ring groove. Fig. 8—Relieving sides of piston

slowly. After the furnace has reached the required temperature, it is held at this heat for several hours and allowed to cool down with the castings in the furnace. This treatment not only makes the pistons easier to machine, but also removes internal stresses and insures more satisfactory pistons.

In the first operation, the open end of the skirt is bored and faced on a 14-in. Reed lathe, fitted with a special rear tool-slide which carries the facing tool upside down. The piston is held on an expansion arbor by buttons that are forced in contact with the inner wall by a cone inside the arbor. This method holds the piston true with the core, so as to insure a wall of uniform thickness when the piston is turned. It also locates the piston definitely lengthwise, the inside limit being 0.005 in. This accuracy is secured by means of stops on the lathe bed.

The head of the piston is also centered, using a combination center drill and countersink, held in the tailstock and operated by a lever. The first operation is shown in Fig. 1. The open end of the piston is then reamed under a vertical drilling machine, using a floating reamer, as in Fig. 2. The piston is supported by its center and is held against a true face plate, so that the reamed hole will be square with the end of the skirt. As this reamed hole is used in locating for other operations it is held to 0.0015 in., plus or minus.

Using the reamed hole and the end of the skirt as a guide, the piston goes to the Sundstrand stub lathe shown in Fig. 3, and is held firmly in place by the center. Here the piston is automatically turned, grooved and the head faced and beveled. One operator and one set-up man, handle six of these machines. The center projection is next removed in a tilted-turret lathe, Fig. 4, the piston being held in a spring collet-chuck, which permits removal without stopping the machine. Again using the open end of the piston as a location point, the cross hole is drilled and reamed in the fixtures shown in Fig. 5. These fixtures slide on the rail shown for convenience in loading. The same operator runs both machines, moving the piston from one machine to the other.

If the piston is to be bushed, the work is done on the hand-operated arbor press shown in Fig. 6, although an air press is soon to be used in its place. The bushings are next line-reamed to insure squareness of the holes with the skirt. The limit of out-of-squareness is 0.002 in., the maximum being one-half the clearance allowed between the piston and its cylinder. The piston has a ring groove at the bottom of the skirt and six $\frac{1}{8}$-in. holes are drilled, as in Fig. 7, through which the oil can return inside of the piston.

The piston is relieved on each side over the pin boss, as is common practice, about $\frac{1}{64}$ in. being removed at this point. The relief is secured by means of a cam on the body of the chuck which holds the piston, as shown in Fig. 8. The cam controls the movement of the tool in the cross-slide.

The head of the piston is next ground, while held and located by the open end as before. The open end is also slightly chamfered to remove the sharp edge, the chamfering tool being guided by a pilot.

Grinding the outside of the piston is the finishing operation, the head being from 0.005 to 0.01 in. smaller than the skirt. Pistons for Fords are usually made to size while those for other makes of cars are sent out semi-finished. These latter are not ground and are left 0.08-in. larger than the motor builders' standard, to allow for fitting.

Europe Resumes Its Former Automobile Production

Europe is rapidly resuming her place in motor production for foreign markets, according to Percy Owen, chief of the Automotive Division of the Department of Commerce, who has just returned from a survey of market conditions in European countries. The operation of the Dawes plan, following the period of reduced activities, and the revival of interest on the part of investors in industrial securities are the prime reasons advanced by Mr. Owen as having brought about Europe's automotive awakening. The motor car, for years, he points out, was one of the principal exports of the manufacturing countries, and with the revival of industrial activities it has been but natural that European manufacturers should return to the field where they formerly held such a strong position.

Cincinnati Saddle-Type Plain Cylindrical Grinder

By Fred H. Colvin
Editor, *American Machinist*

A machine in which all movements for each function are controlled by a single lever, centrally located, with a treadle that stops and starts all movements of the work and water

A SELF - CONTAINED, saddle-type, cylindrical grinding machine that embodies a number of interesting features has just been announced by the Cincinnati Milling Machine Co., Cincinnati, Ohio. It is built in two sizes, 8x18 in. and 8x36 inches. A front view of the machine is shown in Fig. 1, while Fig. 2 shows the back, the motor and one end of the saddle.

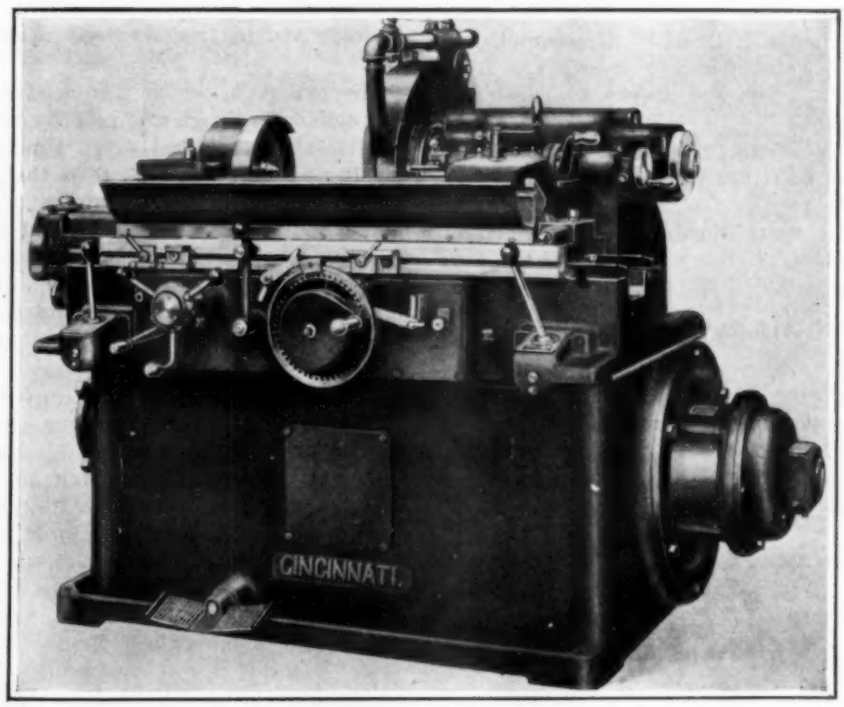


Fig. 1—Self-contained, saddle-type 8-in. grinding machine

The construction of the bed differs materially from the usual design. The aim has been so to distribute the weight as to increase the rigidity of the whole machine. The location and mounting of the various parts are such as to eliminate avoidable vibration. Instead of a wheel head that moves to and from the work for securing different diameters, the wheel head in this case is bolted solidly to the machine bed, while the work saddle moves across the bed, carrying with it the tables and work-supporting members.

This arrangement takes advantage of the weight of the sliding table, the swivel table, both head and footstocks and that of the cross-saddle itself, to make up the mass that must absorb vibration due either to the wheel or to the pressure against the work. A construction in which the wheel head is a rigid part of the machine makes it possible to greatly reduce the weight of the wheel head while at the same time securing the rigidity necessary in a modern grinding machine.

The construction of the wheel-head and spindle bearings is of special interest. The head itself is amply proportioned for its work. The wheel spindle is a chrome-nickel steel forging and heat-treated. It runs in bearings of the half-box type, the box being of cast iron with a lining of special babbitt held in place by interlocking dovetail slots. The downward pull of the belt holds the spindle in its bearings, this construction avoiding the delay sometimes found necessary in warming up a machine to its running temperature in order to secure duplicate work. Lubrication of the spindle is automatic without the use of a pump. Large disks are mounted on the spindle and revolve with it. These disks or splashers are partially submerged in oil and convey oil to a collector in each bearing cap from which it is distributed over the entire spindle journal. While there is no bearing on the upper side of the spindle there is a cap, out of contact with it, that prevents the spindle from tilting or jumping should the driving belt break. End thrust is taken care of by a double-thrust ball-bearing, adjustable by a knurled hand nut outside the bearing and locked with a setscrew. End adjustment can be made easily while the spindle is running.

In order to appreciate the way in which the different mechanisms are tied together, the diagram in Fig. 3 should be studied. Power goes from the main driving pulley to the grinding-wheel spindle, a tightener maintaining the proper tension. The main drive shaft also supplies power for the work, table and pump, through the friction clutch shown, the belt and pulley diameters being shown in each case.

The change-gear box for varying the speed of the

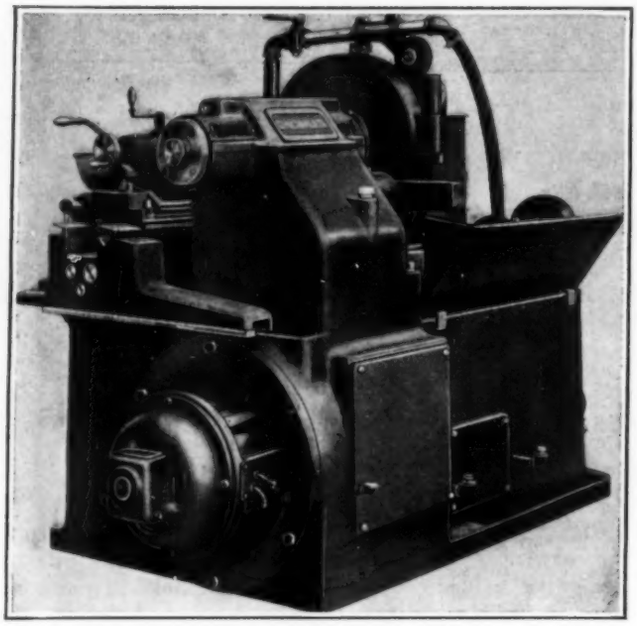


Fig. 2—End view showing motor

work has six changes. The gear box for the table traverse has twelve changes, six of them accomplished through back gears. Table traverse speeds are from 12 to 192 in. per min. The low speeds are desirable when truing the wheel.

The diagram also indicates that the automatic cross feed of the saddle can be either continuous or intermittent. The continuous feed is from 0.0004 to 0.004 in. per revolution of the work head. The intermittent feed is 0.0004 to 0.004 in. at each reversal. Either feed can be thrown in at will.

Maintaining Alignment of Parts

The base unit has a three-point bearing, feet being cast to project from the bottom and so compensate for unevenness in the flooring or foundation. The base is planed and scraped and the machine assembled while resting on these feet to insure permanent alignment. The ways of the saddle are chilled to reduce wear to a minimum.

Since the alignment of the saddle is of the utmost importance its construction and operation are of special interest. The upper surface of the bed has a heavy V-shaped slide-way at right angles to the grinding spindle and nearly central with the grinding wheel. In addition there are flat slide-ways at each end of the bed. These three ways, shown clearly in Fig. 4, give the advantages of ample support in connection with the principle of the narrow guide. In order to take advantage of this principle, a feed screw, of large diameter, is located in the saddle V, as can be seen. This combination overcomes any tendency of the saddle to cock or twist out of alignment in feeding the work to the wheel.

The saddle is cast in cellular form, both for stiffness and to provide chambers for housing the gear boxes that control both table and work speeds. The cells have cover plates and form dirt and leak-proof reservoirs for oil, insuring constant and adequate lubrication.

The saddle, carrying as it does the sliding and swivel tables with the head and footstocks and automatic reverse plate, has sufficient weight to hold it firmly on its ways and be free from vibration, even under heavy cuts.

The extent to which the controls have been simplified and centralized can best be seen in Fig. 5. The handles shown control every function of the machine and the outstanding feature is that every movement of each function is controlled by a single lever. The levers are so spaced as to afford ample room for the operator's hand, to be easily grasped, to afford a positive hold and to avoid the possibility of barking the knuckles. All feed gearing and clutches are of hardened steel, and are built in interchangeable units. They all run in oil.

Beginning at the left in Fig. 5 the lever *A* controls the speed of the table traverse. It is an automobile-type gear shift that gives six table speeds at will and without touching any other lever. Each speed is marked on the plate below the lever. The control of the table, however, is centered in the three-arm pilot wheel *B*, carried by the automatic reverse plate. This unit controls all three functions of table movement. It serves as a handwheel for the manual movement of the table; it acts as a clutch-control lever for engaging or disengaging the power traverse and also enables the table to be set so as to dwell or tarry at the end of the stroke. Any one of the three pilot arms can disengage the power traverse clutch and the table can be moved by the same handle, or the power can again be thrown in at will. This combination avoids the necessity of using two hands. With the power clutch in, the pilot wheel remains stationary. The reversing mechanism for the table is of the "load-and-fire" type to insure stopping and reversing within close limits.

The "dwell" or "tarry" for the table at the end of the stroke is embodied in the table-clutch mechanism and is controlled by the pilot wheel for the table. For such work as grinding parts having shoulders that are not

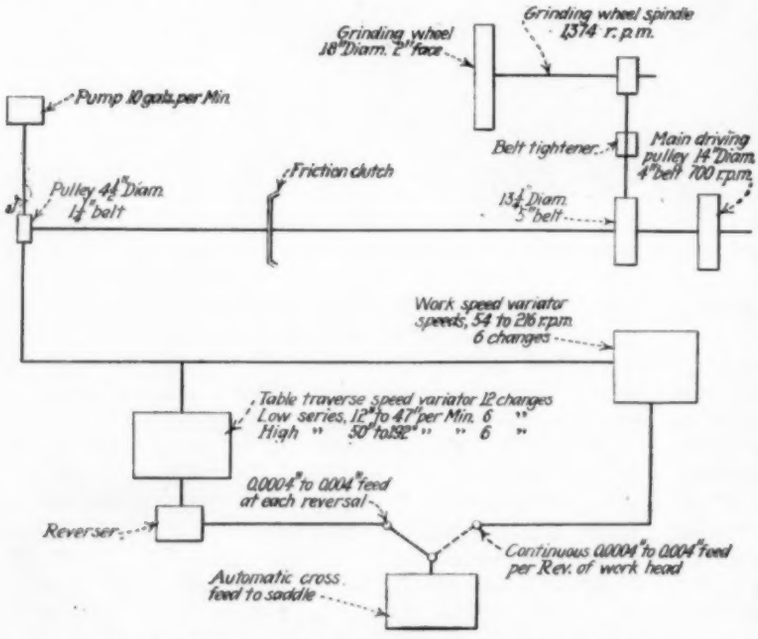

Grinding wheel spindle 1374 r.p.m.
Grinding wheel 18" Diam. 2" face
Pump 10 gals. per Min.
Belt tightener
Main driving pulley 14" Diam. 4" belt 700 r.p.m.
Friction clutch
Pulley 4½" Diam. 1¼" belt
13¼" Diam. 3" belt
Work speed variator speeds, 54 to 216 r.p.m. 6 changes
Table traverse speed variator 12 changes
Low series, 12" to 47" per Min. 6 "
High " 50" to 192" " 6 "
0.0004" to 0.004" feed at each reversal
Reverser
Continuous 0.0004" to 0.004" feed per Rev. of work head
Automatic cross feed to saddle

Fig. 3—Diagram of power and feed transmission

necked or grooved, it is particularly useful, because under these conditions the face of the wheel cannot overlap. As the combination of work travel and rotation produces a helical path and the pitch of the helix is less than the width of the grinding wheel, it is necessary to continue the rotation of the work at the end of the stroke before reversing. The dwell is secured by a clutch which delays connecting the return drive until the work has made a number of revolutions.

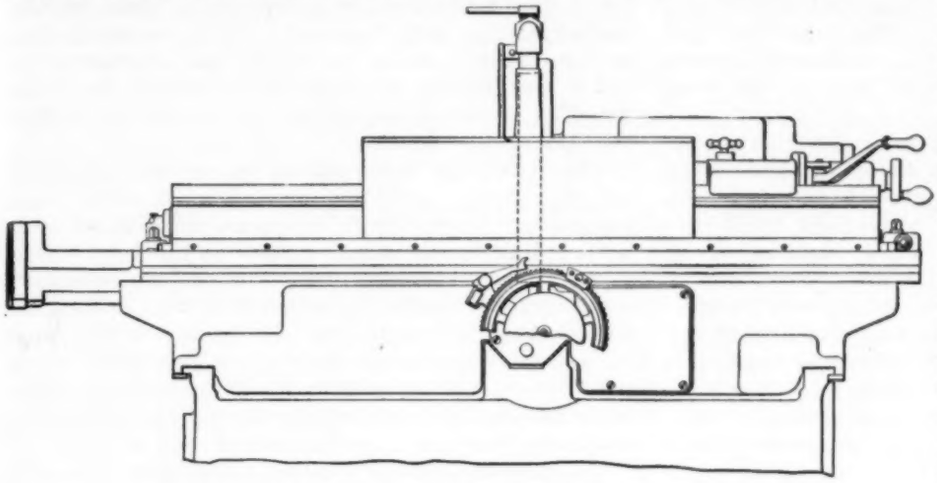


Fig. 4—The V central guide and two outer supports

Cross-Feed Control

The cross feed of the saddle is entirely controlled by the wheel *C*, Fig. 5. It may be operated either by hand or automatically by power, and made to size the work accurately. It can be of suitable coarseness for removing stock rapidly, or fine enough to produce a smooth finish. There is a positive stop for duplicate work when feeding manually which can be adjusted to any position by hand. It can be automatically thrown out when feeding by power, after the work has been reduced to a previously determined size. The cross-feed unit has been designed with special care for the convenience of the operator. It is mounted in a fixed position on the saddle casting and gives a movement to the saddle that is mathematically correct in relation to the movement of the micrometer feed.

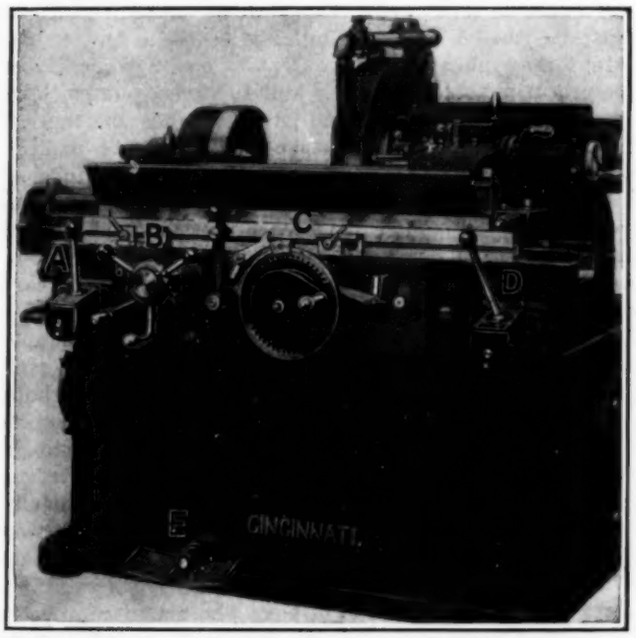


Fig. 5—How the controls are conveniently centralized

The speed of the work is controlled by an entirely separate unit, at *D*. This mechanism is a duplicate of the traverse unit. All gears are of hardened steel, sliding on hardened shafts having multiple keys integral with the shaft itself. The various changes of work and table speeds can be used in any combination with the table traverse. This makes possible slow traverse and high speed or the opposite.

The only other control is the treadle *E*, convenient to the operator and by which he can instantly start or stop everything but the wheel, including the flow of water on the work. This feature is particularly useful in calipering work, as a single movement of the foot stops the travel of the table, the revolution of the work and the flow of water, leaving the work ready to be gaged or calipered. The operator's hands are always available for removing or replacing work, for putting in a new blank or for calipering.

The sliding table is controlled by easily adjustable dogs that strike the reverse lever of the load-and-fire mechanism in the automatic reverse plate. The reversing dogs permit a fine adjustment for grinding to shoulders, and allow the table to be traversed beyond the points of reversal without disturbing the original setting. This feature allows the dogs to readjust themselves after the table has returned to its original position.

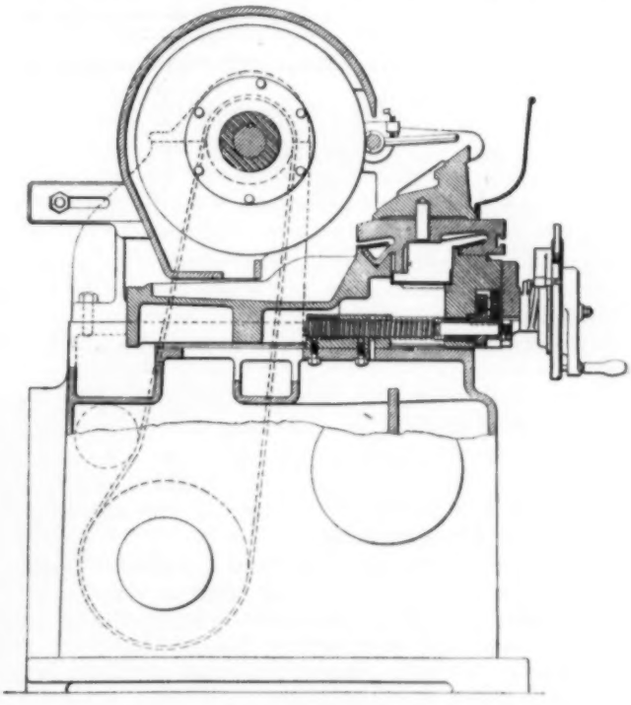


Fig. 6—Cross-section through bed

The swivel table bears on the sliding table, pivoting on a good-sized hardened and ground stud. By setting the table to the desired angle tapers can be ground without throwing the centers out of alignment. The table is swiveled by a worm and segment, the graduations showing degrees, taper in inches per foot and taper in per cent. These graduations read up to 7 deg., 3 in. to the ft. and 25 per cent. The table can, however, be swung beyond these points without disturbing the adjusting device and is limited only by the wheel slide.

Both headstock and tailstock are adjustable on the swivel table, being locked by a large bolt and clamp. The headstock spindle is hollow, ground taper to receive the work-carrying center, and is revolved by a steel worm and hard bronze worm wheel, running in oil. Both head and tailstock have the same taper, No. 10 Brown & Sharpe. The tailstock spindle can be operated either by a handwheel or by a quick-acting spring, controlled by a lever. It has a full-length bearing in its barrel which is adjustable to compensate for wear.

There is also a convenient device for holding a wheel-truing tool so that the wheel can be trued without removing the work.

Suitable back rests are provided to insure uniformity in long, slender shafts. They are universally adjustable. The water pump, of the centrifugal type, does not require priming and is so designed that its bearings do not come in contact with the water. Water guards are proportioned to catch and return the spray and waste water to the settling tank and protect the floor.

The compactness of the general design can be readily seen from the sectional view in Fig. 6, cut through the saddle to show the short and substantial cross-feed screw, the length of the nut and the substantial bearing at the outer end. The gearing and the cross-feed mechanism are shown at the right. This view shows the sliding table with its guiding V in front and the flat way at the back, together with the swiveling table on top. It also shows the cellular construction of the saddle and the way in which all the stresses due to the grinding operation are taken well within the walls of the bed of the machine.

The drive for the machine is self-contained, the various shafts and the driving mechanism being mounted in the bed itself. There are no overhead works and nothing but the machine rests on the floor, making it easy to sweep around it. This design allows the machine to be readily moved at any time. When belt driven there is a tight and loose pulley carried in an outboard bearing in the base. For electric drive, the pulley is replaced by a motor, bolted to the bed by a circular adapting ring, which holds it firmly to the machine, above the floor and accessible for removal or repair.

The machine swings 9 in. over the table, and takes 18 in. and 36 in. between centers. Work speeds run from 54 to 216 r.p.m. and table speeds from 50 to 192 in. per min. The grinding wheel is 18x2-in. face, the front spindle being 7x3 in., and the rear bearing 5x2¾ in. The height of the center from the floor is 43 in., the motor is 10-hp. and the net weights are 4,680 and 4,890 pounds.

The Mechanical Engineer—Discussion

BY J. HOWARD STUDHOLME

On reading your editorial entitled "The Mechanical Engineer," in the *American Machinist*, Vol. 61, No. 24, I was impressed with your question as to whether the all-round machinist has gone to the land of the dodo and other prehistoric creatures. From the point of view of an all-round machinist I am inclined to think he has gone or will soon go if more encouragement is not given to the younger generation to undertake a full apprenticeship.

The trend of the times seems to be to specialize, which may be all right in some cases, but has a tendency to make a mechanic narrow in his views. It may pay better financially but it works an injustice on the boy who serves a four-year apprenticeship and discourages others from doing likewise.

My point of view is that of the master mechanic of a large textile manufacturing plant in which are 37 departments and a vast amount of machinery that must be kept constantly moving by the machine shop. A specialist in my shop would be no good to me as he would produce more parts on his particular machine in a month than we can use in a year. When he got so far ahead in his work that I had to shut down his machine, what other work could I find for him? He would be practically useless elsewhere because of his lack of general training.

In my work I have men that can fill in in almost any position. Some days I can use fifty men, on other days a dozen would be more than enough. The consequence is that I have to build up an average force of men capable of all-round work. I have to be prepared to take care of break-down emergencies and to do that I need all-round men and not specialists. The organization under my direction must be trained to rise to all occasions. The men I hire are all-round mechanics that have served an apprenticeship and are thorough. I observe where they are most useful and put them to work to the best advantage, some on the machines, others at the bench and on assembly. This may sound like specializing but in reality I can draw these men off at any time for any of the emergency jobs.

To give an idea of the variety of work that this force must be capable of handling, I will list a few of the things that must be done: Repairs and new parts for reciprocating steam engines and turbines, pumps, boilers, electric generators and all the other mechanical appliances in the engine room of the plant; making repairs, new parts and improvements on all kinds of textile machinery in the mill, both of foreign and domestic make; repairing and keeping in condition a dozen automobiles from a 5-ton truck to a Ford; designing new machinery and making patterns. And there are many other jobs that come up that we must do.

I hope I have proved my point that a corps of specialists could not handle a job like this. With a good class of all-round men it can be made to pay without going on the outside for anything. The specialist is all right in his place but he will never be able to do the work of the educated all-round machinist. Let us develop the brain and skill of hand of our mechanically inclined young men so that they will become leaders in invention and design and not specialists of production. I earnestly hope that you will use the *American Machinist* to urge the parents of boys who are mechanically inclined to work and study to become all-round American machinists.

Methods of Machine Tool Design

By A. L. De Leeuw
Consulting Editor, *American Machinist*

Considerations affecting the use of the dovetail and square lock—Reasons for the narrow guide—Location and spacing of Vees in various machines

THE combination of dovetail and square-lock used to be quite common and may still be found in certain classes of machinery. To show why such a combination may have reason of existence, we will take the example of the boring mill. It need hardly be said that in order to get the best results with a boring mill the cross rail should be placed as close to the work as possible so as to make the overhang of the tool beyond the cross rail as short as possible. There are many cases where flat surfaces have to be faced and where a short tool can be used so that all conditions will be as favorable as possible provided that the tool holder does not project beyond the bottom of the cross rail more than is absolutely necessary, and this means, of course, that the saddle must not project beyond the rail. This is not possible with the square-lock, so that it will be necessary then to have the bottom of the cross rail provided with a dove-tail. On the other hand, the top of the cross rail can well be made with the square-lock and should be made that way for the reasons that will be given.

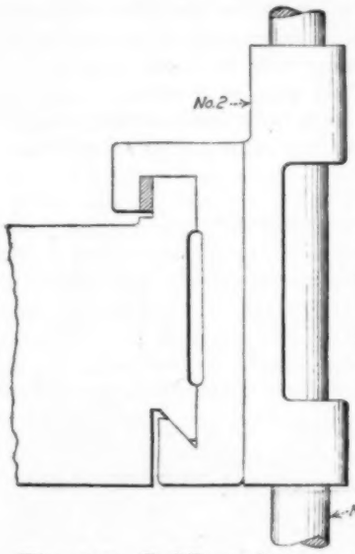


Fig. 267—Saddle and cross rail of boring mill

The saddle and cross rail construction of a boring mill are shown in elementary form in Fig. 267. The boring bar is shown to project downward a long distance. The pressure against the tool is in the direction of arrow 1, so that there is a tendency to move the top of the saddle in the direction of arrow 2. As we have seen before, the unavoidable looseness at a joint is magnified when a dove-tail lock is used; so that if there is any looseness at all at the top of the saddle there will be much more looseness—that is, possible movement—at the tool point. It is therefore necessary to limit the possible movement at the top to the lowest possible amount and this can be reached only with the square-lock. Not only that, but there should be a gib as shown in the illustration.

If a boring mill is provided with two saddles, right and left hand, the left hand boring bar will be pulled whereas the right hand bar is pushed, so that the left hand saddle is subjected to possible movement at the bottom rather than at the top and in that case the dove-tail lock is no longer permissible. That boring mills have been made with two saddles and a dove-tail lock at the bottom either shows that conditions have not been properly analyzed or else that practical considerations, such as using the same cross rail for one or two saddles had been stronger than considerations of proper design.

The point brought up that the cross rail should be as close to the work as possible was quite correct in itself, but it should never be forgotten that it is not wise to favor one part at the expense of another, and if the proper rigidity is required for heavy facing then this can just as well be reached by increasing the size of the rail itself and of its bearings on the housings.

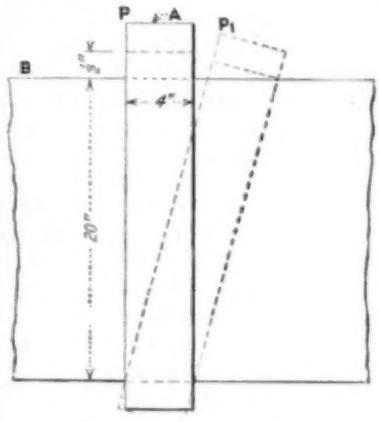


Fig. 268—Sliding members—long axes perpendicular

The Narrow Guide

The narrow guide, though of decided merit, has become more or less a fetish, such as geometrical progression and quick gear-change devices. The quick gear-change device is of great use, but not always. A geometrical progression of feeds and speeds is generally the right thing, but again not always. And similarly, the narrow guide is of decided merit, but there are times and cases where its merit is so little that the extra work required for such a construction may not be justified. It may therefore be well to look somewhat closer into this much debated construction.

In Fig. 268 part *A* is supposed to slide on part *B*. As always there must be some clearance between the two parts or else sliding would not be possible. The illustration is grossly exaggerated so as to get a clearer view of just what happens when *A* slides over *B*. As will be seen, any pressure that is not exactly central will have a tendency to move *A* into a position where

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that clearance is completely taken up. This position is shown in dotted lines.

In Fig. 269 the proportions are changed and again A_1 is supposed to slide on B_1. Here also eccentric pressure has pushed the sliding part over in the position shown by dotted lines. The illustration shows clearly that the angle is less in the latter case and that there has

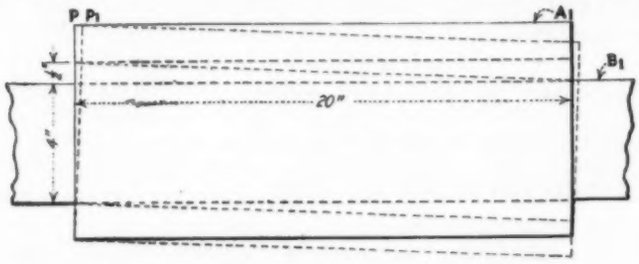


Fig. 269—Sliding members—long axes parallel

been a smaller amount of sidewise displacement; in other words, the possible movement of the slide has been reduced.

The narrow guide is nothing but this: that a long slide moves over a narrow support while in the other case a relatively short slide moves over a wide support. It is therefore impossible to say with certainty whether a given construction has the narrow guide or not. It is a matter of degree, and as such is the case it is not possible to point out with definite figures the difference between the two constructions, though it is possible to take definite conditions and compare them.

In the two illustrations, Figs. 268 and 269, extreme conditions such as are not met in practice have been taken. The actual difference in their action is therefore much more than we would meet in reality, but the nature of this difference is the same. To illustrate this nature we will choose figures to bring out the difference in a clean-cut manner. In Fig. 268 the width of the slide is supposed to be 4 in., while the width of the support is supposed to be 20 in., and the initial clearance between A and B is $\frac{1}{2}$ in. In Fig. 269, on the other hand, the width of the slide, which might be called its length here, is 20 in., the width of its support is 4 in., and the initial clearance is again $\frac{1}{2}$ in. Under these conditions the endwise movement of the point P in Fig. 268 is 1.996 in., whereas in Fig. 269 it is only 0.09892 in. The angle through which the slide has turned in Fig. 268 is 5 deg. 41 min., while in Fig. 269 it is 1 deg. 25 min. Though these figures do not indicate what happens in reality when we are dealing with existing slides, they do indicate that there is a difference, and when we consider that the permissible movement, looseness, and angularity is always very small we see at once that even with much more favorable conditions than we assumed here, we are liable to double or treble the amount of endwise movement by making the proportions between slide and width of support unfavorable. We see that the most favorable conditions will be reached when we have a long slide moving over a relatively narrow support.

These conditions are automatically met in certain kinds of machines. The lengthwise moving spindle in a boring machine travels in a narrow guide. So does the table of a planer and the ram of a shaper. On the other hand, the carriage of a lathe, as well as the tool slide of a lathe or a planer, often works under the opposite conditions.

Even though the amount of movement or the angularity of the slide may be small enough so that there is no perceptible trouble, yet there is another condition not mentioned yet which affects the wear of the parts very materially. Referring again to Fig. 268 we see that the slide A bears against support B at a single point. Now as a matter of fact there is never a condition where one piece bears against another under pressure and at a single point. The moment there is, pressure compression of both parts takes place, so that there is in reality never a point contact but always a contact over a certain amount of surface. This amount depends on several things. One of them is the compressibility of the material, and this we can leave out of consideration here because we naturally assume that we are dealing with the same material whether we use the narrow guide or not. Another is the amount of pressure, and this again we may assume to be the same. Still another is the angle under which one part bears on the other. If we should take a strong needle, place it at right angles to a piece of wood and press on it, it would penetrate to a considerable distance. If we should have placed this same needle at an angle with the piece of wood and pressed it in the same manner as before, it would have penetrated very much less. The reason is that, in the first case, a certain amount of penetration did not increase the area of contact between needle and wood to any large extent; in the second case it did.

In the case of Fig. 268 a certain amount of penetration of slide A into support B and a corresponding flattening of the piece A itself did not increase the area of contact as much as it would in the case of Fig. 269. The amounts with which we are dealing here are very small, but their proportion is as indicated; namely, that with the narrow guide a larger area of contact will be formed under a given pressure, whereas in the case of Fig. 268 a smaller area of contact will be found. As a result, wear will be much greater in the case of Fig. 268, and as soon as a certain amount of wear takes place the angle and the lengthwise displacement are still further increased so that conditions

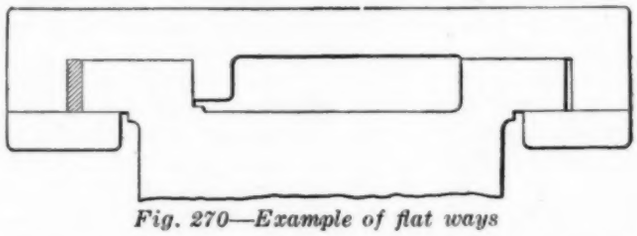


Fig. 270—Example of flat ways

become worse instead of better. As a matter of fact it will be found that unless the proper proportions are followed there will be excessive wear and the shorter of the two pieces, in this case piece A, will wear round or bell-mouthed.

Apparently then the thing to do is to make piece A long as compared to the width of piece B. This is naturally so in the case of planers, etc., and in such machines we do not speak of the narrow guide. In a lathe also we could obtain the same results by giving the carriage a length equal to several times the width of the bed, but this is, for obvious reasons, not practical. However, it is not necessary that the carriage itself should have such a great length; all that is necessary is that that part of the carriage which guides its movement shall be of a length several times the width of that part of the bed by which it is guided.

In a lathe in which Vees are used, this is automatically so, which is probably one of the reasons why the Vee guide on a lathe has been in such great favor for so many years. In other words, the lathe was constructed on the narrow guide principle before the term "narrow guide" was ever used. On lathes with flat ways, on automatic machinery, on gear cutters, etc., a narrow

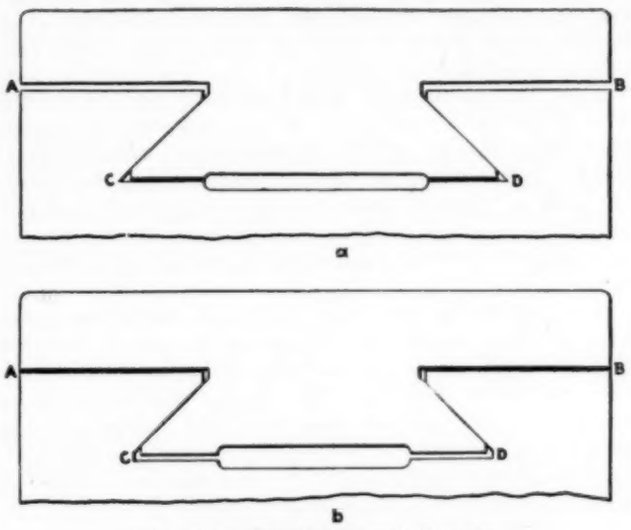


Fig. 271—Typical dovetail locks

guide is made artificially by the proper arrangement of the guiding surfaces.

Such an arrangement is shown in Fig. 270. The side gib is shown here as being on the outside of the bed. Quite often the gib is placed on the inside. So far as the guiding itself is concerned the placing of the gib one way or the other has no effect, and the selection is generally controlled by other conditions of construction.

In Fig. 271-a two parts are shown connected by a dove-tail lock. It is not humanly possible to scrape the surfaces with such a degree of accuracy that the top part will rest on the bottom part on the planes *AB* as well as *CD*, and a choice must be made. The illustration shows that the plane *CD* has been chosen, and the question has often been raised as to which of these two planes will give the best results. Considering that the plane *AB* gives a much broader surface to rest on than the plane *CD*, it is evident that this plane *AB* should have been chosen and that the construction should have been as shown in Fig. 271-b. If that part of the top slide which lies between the two dove-tails were very wide and those parts which lie outside of the dove-tail were narrow, then it would have been better to select the plane *CD*, because this would give a more stable support as there would be less danger of the bending of the upper part under load. However, a construction where the dove-tail would be of great width and the overhanging part would be narrow would be a poor construction at the best; so that it may be said that, as a general rule, the support should be on the plane *AB*. Of course, special conditions may come up which may make it advisable to do otherwise.

In general it may be asked where the supports for a sliding member should be placed. Take, for instance, a planer table. Should the Vees be placed close to the outside of the table, or near the center, or, in general, where? If the Vees are placed too close to the center there is danger of tipping the table if most of the load should come near the outside. If, on the other hand, the Vees were placed close to the outside there may be danger of bending the table if the load is concentrated on the center.

It is, of course, impossible to have the Vee placed to the best advantage for every possible distribution of load and pressure of cut which one may meet, and it is therefore advisable to make a compromise on the basis that the load is evenly distributed over the entire width of the table. This makes it desirable to place the Vee so that there shall be a minimum of deflection.

In Fig. 272 is illustrated a planer table of a total width of l, the outside overhang beyond the Vees being a. From any point situated at a distance x from the outer edge of the table, the moment of the bending forces is $M = \frac{Px}{2}\left(\frac{x}{l} - 1 + \frac{a}{x}\right)$. The resistance of the table against bending varies with the value of a, and becomes the maximum when $a = l(\sqrt{\tfrac{1}{2}} - \tfrac{1}{2}) = 0.207l$, so that, for all practical purposes, we may say that the distance between the center line of the Vees should be three-fifths of the width of the table. Though this proportion isn't the best for all conditions which may arise, it is the best compromise which can be made. If the table is considerably smaller than the width between the housings, this width between housings should be taken for the value of l.

In most cases, the question as to where the support should be placed is of academic interest only. Parts are usually made so heavy and the deflection is so small that a certain amount of variation in the location of the supports from what is theoretically ideal makes no perceptible difference in the actual conditions. Besides, in the majority of cases other considerations locate the position of the support. For instance, in a lathe carriage the Vees may or may not come in the location most favorable for strength and rigidity. Generally they do not, but the other requirements of the lathe overshadow the requirements of the location of the Vees with a view to the strength of the carriage; and yet it cannot be denied but that it would be of

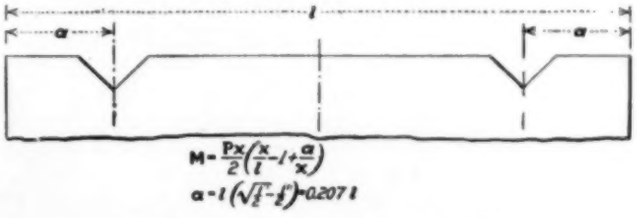


Fig. 272—Diagram of planer table

some advantage if we could always place the Vees of a lathe where they should be, because a lathe carriage is generally the weakest member in the machine. In a planer the position of the Vees is of quite some interest and particularly so in wide planers. The location of supports is also of interest in such machines as boring machines in which the table is raised by a pair of screws, but as a whole the problem is of minor importance. Where beds are supported on legs, an attempt should be made to make the bed so rigid that the machine would still do good work if it were hung from the crane; and in long machines, such as long lathes, where the bed could not possibly be made of such rigidity, the machine should be placed on a foundation so that it, and not the bed of the machine, becomes the supporting member.

Industrial Standardization Development in 1924

MOST of the great firms are coming to have some definite organization for their standardization work, instead of leaving it as a more or less incidental part of their engineering and production activities. Increasing competition is bound to result in some form of definite organization for the work in the majority of all but the smallest companies. This has already taken place in Germany, where more than 1,000 firms have such organizations. Some of the larger companies have from 100 to 200 members of their staffs devoting full time to such activities. The increase in the number of associations and companies affiliated in the membership of the American Engineering Standards Committee is a notable step in this direction.

Standardization is becoming one of the most important and appreciated activities of trade associations, which are the principal mechanisms through which management arrives at collective industrial policies. About 150 trade associations are now officially participating in the work of the A. E. S. C. through accredited representatives.

About 70 standards have been approved by the American Engineering Standards Committee, and 100 others are under way. Of these, 32 have to do with civil engineering, and the building trades; 26 with mechanical engineering; 15 with electrical engineering; 4 with automotive subjects; 11 with transport; 1 with ships and their machinery; 14 with ferrous metals; 15 with non-ferrous metals; 12 with chemical subjects; 2 with textiles; 16 with mining; 5 with the wood industry; 1 with the paper and pulp industry, and 11 are projects with topics of a miscellaneous or general character.

The U. S. Federal Specifications Board has now adopted nearly 300 specifications. These are used as a basis of purchase throughout the Federal government. The A. E. S. C. has continued its co-operation in this work, and during the year has circulated more than 100 specifications for criticism.

Simplification Still Going On

The third year of the work of Mr. Hoover's Division of Simplified Practice has shown extensive development. In all, 26 simplifications have been carried through, 10 others are in the final stages, and 45 additional surveys are now under way. Two hundred industrial groups are co-operating in the various projects.

The work on the "Dictionary of Specifications" is being carried out by the Bureau of Standards and that of Foreign and Domestic Commerce, and the book is nearly ready for publication. This will consist of a classified list of all of the more important purchase specifications in existence in this country. It has been carried out primarily for the use of public purchasing bodies, to which, as well as to industries in general, it should be of great service.

The co-operation of the Federal Government with industry, through the machinery of the A. E. S. C., steadily increases; in fact one or more arms of the government are co-operating in nearly every one of the A. E. S. C. projects. The Bureau of Standards and the Federal Specifications Board jointly maintain a liaison officer in the American Engineering Standards Committee.

The most important piece of work completed by the A. E. S. C. in the mechanical field during 1924, was the promulgation of the standard for screw threads, a subject which touches practically every industry. This was worked out in co-operation with the National Screw Thread Commission. Good progress has been made in two other far-reaching subjects, gages and systems of gaging, and pipe flanges and fittings. Parts of the work on both these subjects are now nearly ready and will be issued soon.

Work on dimensions and tolerances for nuts and bolts is also well advanced. At an informal conference of representatives of the American, Czechoslovakian and German committees, it was recommended that there be held a general international conference looking toward international agreement, so that there may be international interchangeability in regard to wrenches, nuts and bolt heads.

Standardization activities in foreign industrial countries continue to increase. Among the newer national organizations those in Czechoslovakia and Japan are showing great activity. The former has approved 5 standards, and has no less than 176 other projects under way, and the latter is working on 47 projects. In all there are now nineteen national standardizing bodies, as follows: Australia, Austria, Belgium, Canada, Czechoslovakia, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Norway, Poland, Russia, Sweden, Switzerland, and the United States.

What is a Used Machine Tool Worth?—Discussion

By Harry Ensminger

In an editorial under the title given above on page 667, Vol. 61 of the *American Machinist*, the editors bring up a suggestion that has long been a bone of contention with me.

It is a well known fact that prices obtained for used machine tools are, in the majority of cases, very unfair. As the article under discussion points out, the dealer always emphasizes the defects and then starts to beat down your price. Often the so-called defects are practically nothing, and will not interfere with the operation of the machine. Another thing the dealer takes advantage of is the fact that most machine shops have their used machine tools stored in a corner or "graveyard." The machine will show up to a disadvantage, creating a bad impression, and as this type of impression is purely a psychological one the dealer is quick to grasp it. Everybody knows that a psychological impression is transferable and the dealer is further helped in beating down the seller's price by the clever use of the psychological facts governing the case.

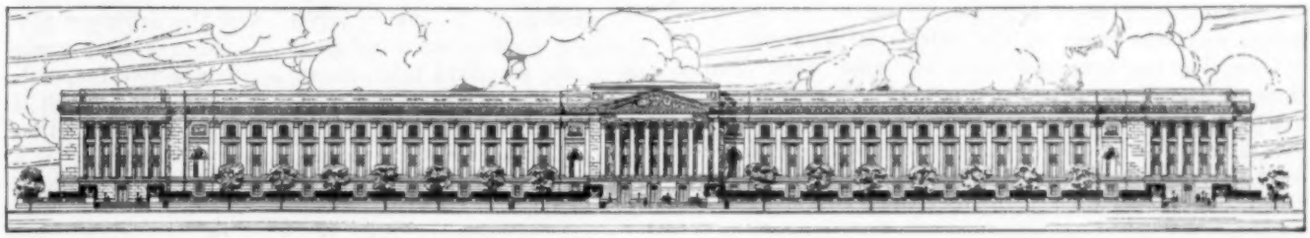
I believe some sort of a plan could be made up whereby the depreciation could be figured according to the actual age of the machine in machine hours. Of course, to establish a good all-around price for used machine tools, lots of research work will be needed.

I consider the machine-hour life as an excellent basis on which to work. It is a very good flexible basis, it would allow a broad survey in establishing depreciation, and if one shop had given their machines better care than another, the dealer would be free to enhance his price. I believe that a better understanding would be created between seller and dealer.

The National Museum of Engineering and Industry

WE HAVE art galleries and libraries for the preservation of early paintings and books which show progress through the years. There are museums in which the growth of the human races and the development of the animals are carefully kept, that students of all ages may study what has gone before. But in this country at least, we have almost nothing but the Smithsonian Institute in Washington to show in any way the development of industry.

There is not a leading nation of Europe without its great national museum of applied science, engineering and industry. Some of them have been in existence for over a hundred years. They are looked upon as serving a purpose at least as important as the art galleries and libraries, and are given the same consideration. These museums preserve a tangible record of the evolution of industry in those countries. Beginning with the earliest crude inventions, they show the steps which led to what we consider the perfection of the present day. They afford the opportunity of studying the development of different inventions and so prevent the waste of effort in needless duplication. How great is the cost of this duplication, which is a national waste, no one can say.



Front view of the proposed National Museum of Engineering and Industry to be erected at Washington, D. C.

No Adequate Museum in America

The United States of America is acknowledged to be the leading industrial nation of the world. Here has been developed many of the epoch making inventions that have aided greatly in world civilization, yet we possess no adequate museum of industry in which can be gathered models, early machines, records and data that can play such a part in the education of coming generations. We have neglected the opportunity to preserve many of the earlier machines, machines that were startlingly original in conception and that frequently revolutionized manufacture, not only here but abroad.

Up to the present the Federal Government has erected only the Arts and Industries Building of the U. S. National Museum group at Washington. This building is of brick, and, erected in 1881, has long since been far too crowded to keep pace with the expansion of industry. As a result, and also due to the fact that it is no one's particular business to prevent it, many highly important historical machines, inventions and devices have been lost because there was no place to put them.

There is, however, a movement under way that promises to remedy this long standing defect. Representative Americans in the industries and professions have formed a corporation to promote the establishment of a National Museum of Engineering and Industry. Plans have been prepared for a central museum, located on the Mall in Washington, and functioning under the direction of the Smithsonian Institute. The front of the proposed building is shown herewith, but such a large and imposing building cannot be advantageously shown in a small cut.

This central museum will house thousands of relics hidden in government institutions, and in many cases unavailable for public inspection. Private industries and organizations have signified their desire for such a place of safe keeping for their exhibits. The exhibits, however, will not be confined to American inventions, for it is just as valuable to know what our friends across the sea are doing as to know what our neighbors have accomplished.

In addition in the present museum in Washington, it is planned to have branch museums in various industrial centers. These branches will naturally emphasize the activities of the district in which they are located. In addition, traveling museum exhibits will be sent out from Washington to illustrate the latest advance in industry. They will visit such centers of population as will be most benefited by them, and so will tie up with the interests of the whole country.

Preliminary steps have been taken for the approval of the site selected, in conjunction with the officials of the Smithsonian Institute. The formal approval by the Federal Government will be asked shortly, and it is believed will be forthcoming without question.

The cost of the building is estimated at $5,000,000. To endow the work will take some three millions. The placing of replicas in branch museums will, it is estimated, require the income from about a $2,000,000 bond. A total sum of $10,000,000 will be needed, toward which over $1,000,000 has already been promised.

An Opportunity for Every One to Take Part in the Work

Here is an opportunity for all who are interested in the preservation for the benefit of future generations of such relics, inventions, machines and data as bear on the development of American industry. All who are interested may become members of the corporation. Gifts and bequests will aid in hastening the fulfillment of the plans and the erection of the building.

Those having or knowing of suitable material for exhibits are requested to communicate with the secretary—H. F. J. Porter, Engineering Building, 29 West 39th St., New York. All are urged to give the whole matter careful consideration and to aid it, financially and otherwise.

Spirit Levels in the Machine Shop

By E. F. Creager

IN THIS article I am considering only the ordinary "machinists' level" in common use around machine shops, and do not go into the question of accuracy respecting such instruments as those used by the U. S. Coast and Geodetic Survey, nor those used in high-grade surveying instruments; though I have seen a number of the latter that were badly in error, doubtless because of the careless use to which the instruments had been subjected.

It is to be regretted there is not some way in which legal control can be brought to bear upon the degree of accuracy of instruments placed generally upon the market under the name of machinists' levels. Some of these are levels in name only, and get by because so few men know how to test a level or to appreciate how much a piece of work levelled (?) by it can be "out" before any movement of the bubble is apparent.

Upon looking into the cause of some work coming through the shop so badly "out" as to necessitate re-machining, or in some cases rejection, I found it traceable directly to a "brand-new," "accurate," machinists' level that had lately been purchased by one of the men and used by him to level up his work. When he was told that the new level was "out" he became very indignant and demanded to be shown.

Placed on a surface plate his level certainly did show "true"—even when I had raised one end of its 6-in. length to the extent of a 0.020-in. feeler. This test resulted in my calling in all the levels in the shop, together with their owners, for a general reckoning. Eight levels were checked upon a surface plate with a standard precision instrument, and a committee of four men decided that the bubbles "just moved" when the following thicknesses of packing were removed from under one end.

One 12-in. machinists' level, cast-iron frame	0.050 in.
Two 6-in. shafting levels, cast-iron frame	0.015 in.
Two 6-in. machinists' levels, cast-iron frame	0.030 in.
[1]One 6-in. woodworkers' level, wood frame	0.040 in.
[2]One 3-in. octagon brass level	0.035 in.
One 12-in. machinists' clinometer, cast-iron frame	0.025 in.

Other levels showed a much more satisfactory degree of sensitiveness. In the following cases 0.001 in. of packing was placed under one end and the movement of the bubble when this packing was removed is shown below:

[3]One 4-in. clinometer, wrought-bronze case	$\frac{7}{16}$ in.
One 6-in. medium grade Y-level	$\frac{1}{4}$ in.
One 6-in. ground vial, cast-iron frame	$\frac{1}{16}$ in.
One 12-in. precision level, steel frame	$\frac{3}{16}$ in.

I took this occasion to demonstrate to the men the degree of accuracy to be obtained by means of good levels and to instruct them in the method of using both the surveyor's Y-level and the transit in setting machinery and in aligning large castings for machining. Since that time we have had no rejections of work because of inaccurate levelling, and in several instances the men have reported material saving in time because of being able thus to check otherwise difficult set-ups.

[1]Bottom twisted 0.020 in.
[2]Bottom curved.
[3]A relic of a German machine-gun nest.

I think the transit is one of the most useful (and it is probably the least known) of the appliances that may be used in the erection of large machinery, in the aligning of large pieces to be machined with the machine upon which the work is to be done, or of the machine with the work when portable machines are used.

One of the questions asked me by the men is one that I cannot answer, and I am putting it up to the readers of the *American Machinist*. It is this: "Where can we get reasonably accurate levels for our work at a reasonable price?" I know that there are a few precision levels on the market, but the average workman cannot afford to pay $35 for a 6-in. or $60 for a 12-in. level. Some factories buy them—and keep them in the vault with the Johannson blocks, to be included in photographs of *"our tool room"* or to impress visitors with the *"accuracy of our work."*

Difficulties in Obtaining Levels

I have tried to purchase levels somewhere between the grades of "precision levels" and the ordinary machinists' level—something about the same relative grade as is our standard micrometer between a two-foot rule and a differential interferometer—but find it difficult if not impossible to do so. I could not find one in either of five large hardware stores in our western city of a half-million inhabitants, and was told that no such level was made.

I can understand that grinding the required curve in the vial of a precision level is an expensive operation, and that the loss in testing and sealing the reversible level used in surveying instruments must be great; but the machinists' level does not have to reverse and the cost of the vial should not be so high as to render the price of the finished tool prohibitive to the ordinary user.

I have purchased ground vials from instrument makers and made several levels that check very favorably with the precision level. My preference for a level to use around the shop is one in which the bubble moves 0.100 in. for each 0.001 in. that the end of its 12-in. length is raised. In the more accurate ones the movement of the bubble is 0.300 in. for each thousandth.

I have also purchased some of the so-called "ground vials," in which the "grinding" was apparently nothing more than sandblasting on the lower half. The bubble was much longer than in the ordinary vial and the grinding slightly increased its visibility.

Necessity of the Curve in the Liquid Space

It is not generally known that all vials must have a curve in the liquid space to cause the bubble to "gather"; otherwise the bubble would be very unstable, or would be a straight liquid line. This curve varies from one of a very long radius, used in the ultra-accurate instruments, to one that compares favorably to the humps of a measuring worm—and is just about as accurate.

We can buy 1-in. "mikes" from $3.50 to $5, and I cannot see how a greater cost is warranted by the legitimate expense of producing levels of a corresponding degree of accuracy.

Some years ago I built ten thousand levels for a firm to use as an advertising proposition. I built them to specifications, but in the light of later knowledge I have often wondered how many of them were the cause of unknown trouble.

The Mechanical Man Should Be "Welding Wise"

By J. F. Lincoln
Vice-President, The Lincoln Electric Co.

Arc welding is a tool with which shop men should be familiar—Some examples of savings through the use of electric arc welding

THE mechanic or designer with an article before him to produce has a number of different tools and methods with which to work out the problem. His knowledge of these tools and methods is his working capital and he profits if this knowledge is thorough and complete. The foundry mold, the lathe, the drill press, punch press, planer, hammer and grinder—these have come to be a part of his thinking. They are the accepted methods for doing certain kinds of work. There is another method, however, which no mechanic in fairness to himself should fail to consider and thoroughly master—electric arc welding. To put it in other words he should be "welding wise."

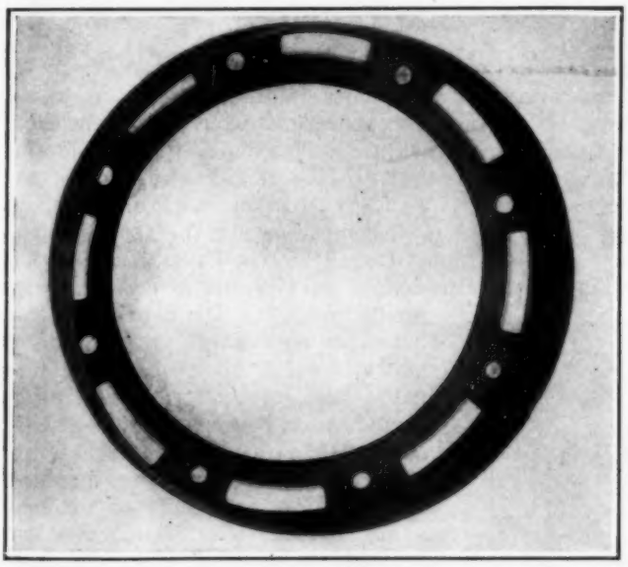


Fig. 1—Frame of an electric motor made by rolling a standard steel angle, and welding ends in the electric arc. The Lincoln Electric Co.

Even a superficial inspection in a few leading manufacturing plants will prove to the most skeptical that here is a coming manufacturing process, one that will not be denied. A few examples will serve to show the nature of the work that is being done and the savings possible, especially at a time when every manufacturer is seeking to reduce his costs in order to save his profit.

An electric motor manufacturer who formerly made the end frames of his motor of cast iron, now makes them by rolling a standard steel angle to a circular shape, Fig. 1, and welding the ends in the electric arc. The costs on a typical frame are as follows:

Cost by grey iron casting	$3.44
Cost by electric arc welding	2.53

In addition to the substantial saving this manufacturer has an end frame that is lighter, stronger, less apt to break and is of small cross section thus leaving more space for coil ventilation.

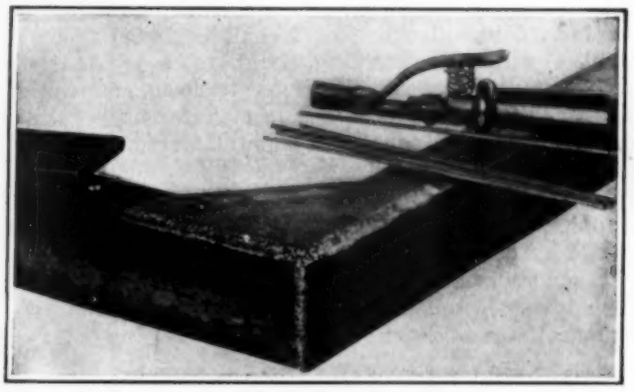


Fig. 2—Elevator floor frame made by electric arc welding. The Haughton Elevator Co.

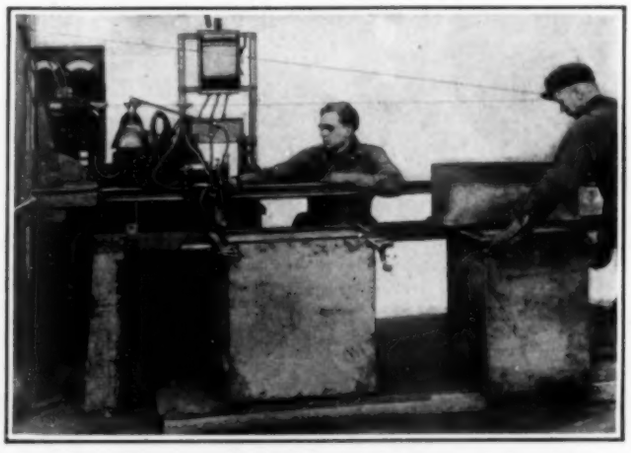


Fig. 3—Welding 40-gallon gas-storage tanks in the plant of the S. F. Bowser Co.

An elevator manufacturer made his floor frames by drilling and riveting together the steel angles. He now

welds the frames with a gusset plate in the corner and has a better frame for less money, Fig. 2. Costs are as follows:

Riveted frame, each	$1.75
Welded frame, each	.60
Net saving per frame	$1.15—nearly 70 per cent.

A manufacturer of underground tanks for gasoline storage formerly used riveting. He now uses automatic arc welding and is producing the tanks at about one-half the cost of riveting, Fig. 3.

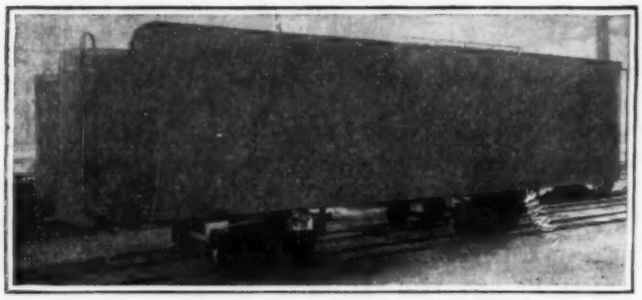


Fig. 4—Locomotive tender made by arc welding in the Baldwin Locomotive Works

A large locomotive builder is building steel tenders complete without rivets, Fig. 4, giving a job that is much better in appearance, easier to clean and paint, and in addition costs much less to manufacture.

An unusual case is that of a manufacturer of concrete sewer pipe who uses wire reinforcing inside the concrete. The reinforcing was formerly held together by wrapping with fine tie wires which gave considerable trouble by coming loose. Today, the laps in the wire are simply "tacked" with an arc welder, Fig. 5. All trouble from loose wires has been stopped and the saving made is as follows:

Cost of reinforcement by former method,	55c. per sec.
Cost of reinforcement by arc welding,	26c. per sec.
Net saving,	29c. per sec.

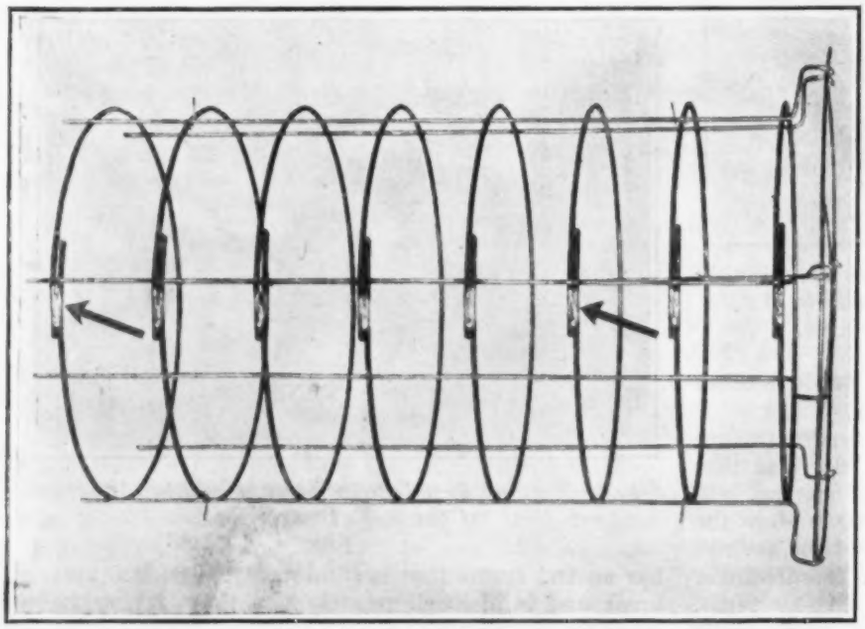


Fig. 5—Frame for reinforcing concrete made by arc welding the lapped joints in the wire

These instances are only a few out of many applications where similar savings and improvements have been effected.

But just how is the designer or mechanic to know when arc welding can be used? One man who is an authority on this work says that the only safe rule to follow is this: "Wherever iron or steel is used in the manufacture of a product there is at least a good chance that electric arc welding can be used, and if so, it will usually save from 25 to 75 per cent over other methods."

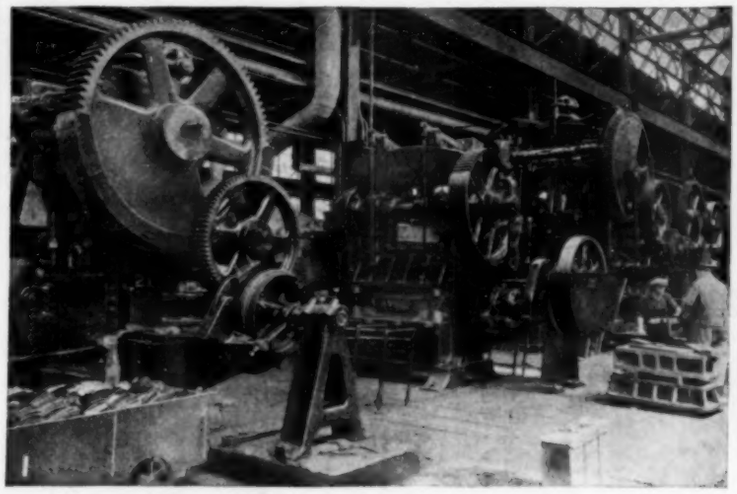
Naturally the good mechanic is conservative and he is not going to adopt any different method of procedure until assured that it is safe and practicable. On this point electric arc welding seems to have long since passed the stage where it could be considered in any sense experimental.

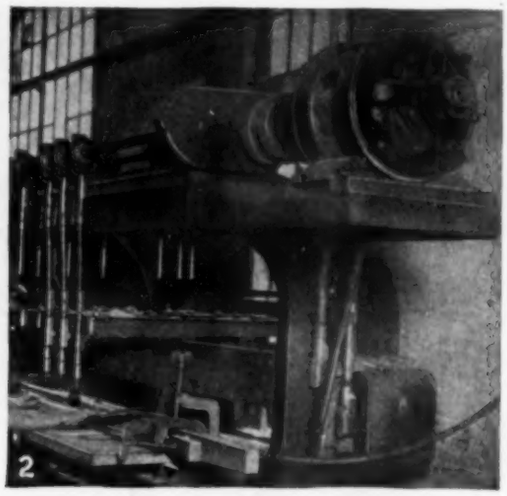
Steel ships completely arc-welded are in daily service; locomotives with frames and other vital parts repaired by this process are a common sight in most railroad shops; leading automobile manufacturers are featuring axles and frames in which the parts "are welded into a solid unbreakable unit." Certainly the day is here when every designer and mechanic should have a working knowledge of this process as part of his training and equipment.

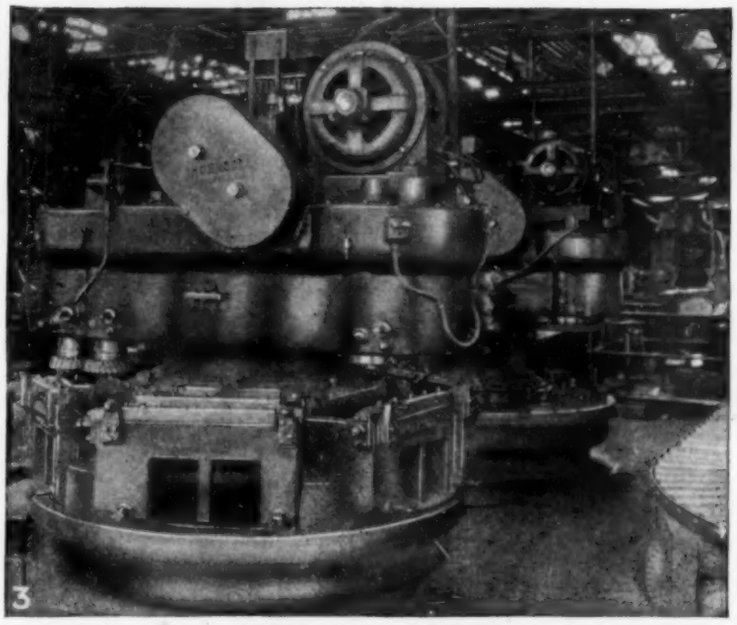
The knowledge of arc welding is not difficult to obtain. The fundamental principle is simply the joining of two pieces of metal either by melting the edges together or by depositing molten metal between the pieces to be jointed. Beyond this it is all a matter of application to individual problems.

Advantages of Standardization

According to F. L. Rhodes, in a talk before the American Engineering Standards Committee, standardization of apparatus, methods and materials is desirable for the following reasons: (1) Standardization makes the best available for all. (2) Standardization reduces cost because, when all companies use the same things, they can be manufactured in the largest quantities and uniformity in output contributes to economies in production. (3) Standardization reduces the cost of carrying stocks of materials and the cost of maintenance and repairs, because fewer parts have to be carried. (4) Standardization reduces the cost of instruction of new employees because there are fewer things to get acquainted with. (5) Standardization reduces accounting costs because there are fewer types and sizes of materials to keep track of. (6) Standardization minimizes complicated engineering and operating problems that might result from intercommunication between widely divergent systems and apparatus. (7) Standardization renders available enormous supplies of materials and labor in emergencies. (8) Standardization greatly facilitates development work. If everything varied from everything else, there would be no definite point of departure from which to start to improve.







Motor Drives in Auto Shops

1—Press department instal lations

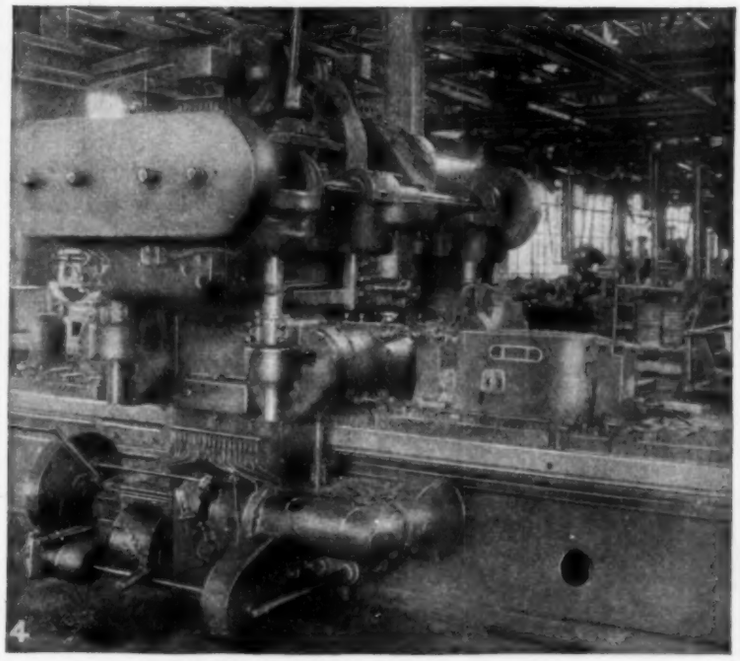
2—Driving a multiple-spindle drill

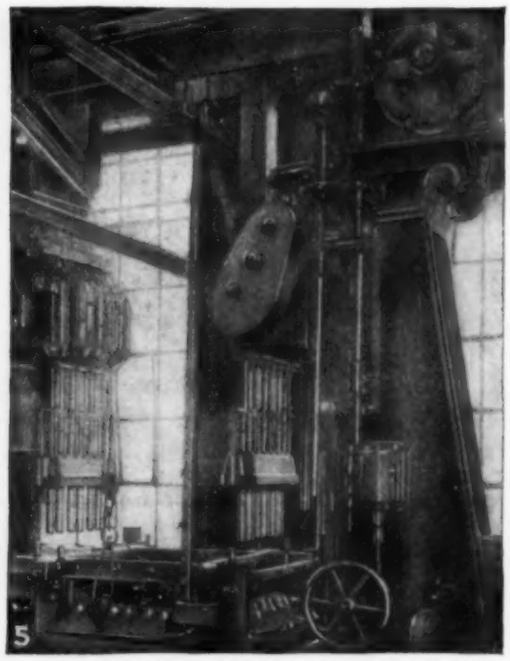
3—Motors on large, continuous milling machines

4—Large planer-type milling-machine drive

5—Motor drive on double-head multiple-drilling machine

Applications by the Westinghouse Electric & Manufacturing Co.





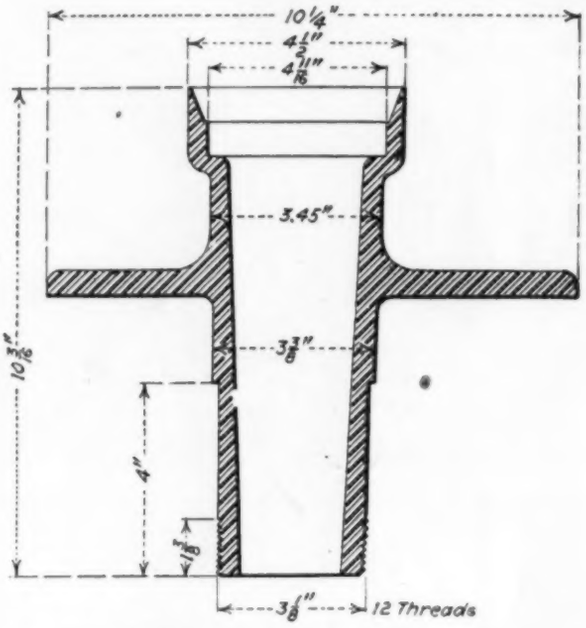


Fig. 1—Artillery-wheel hub. Steel forging—solid. Finish all over. Time, 70 minutes

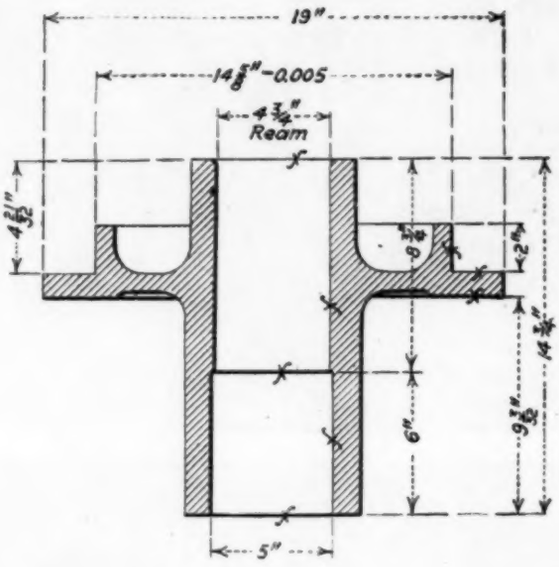


Fig. 2—Stuffing-box bearing. Cast iron—hard. Time, 50 minutes

What Modern Machine Tools Are Doing

The Libby Turret Lathe

Fig. 3—Worm quill. Steel forging—solid. Finish all over. Time, 95 minutes

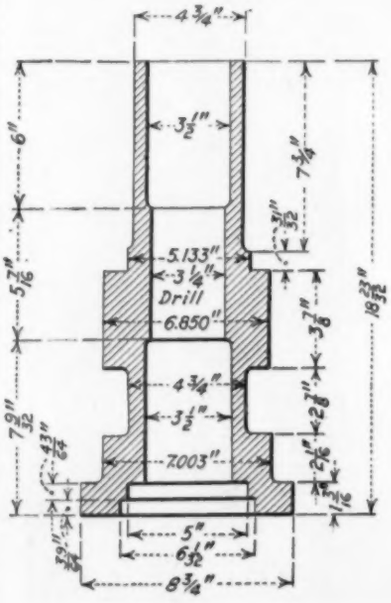
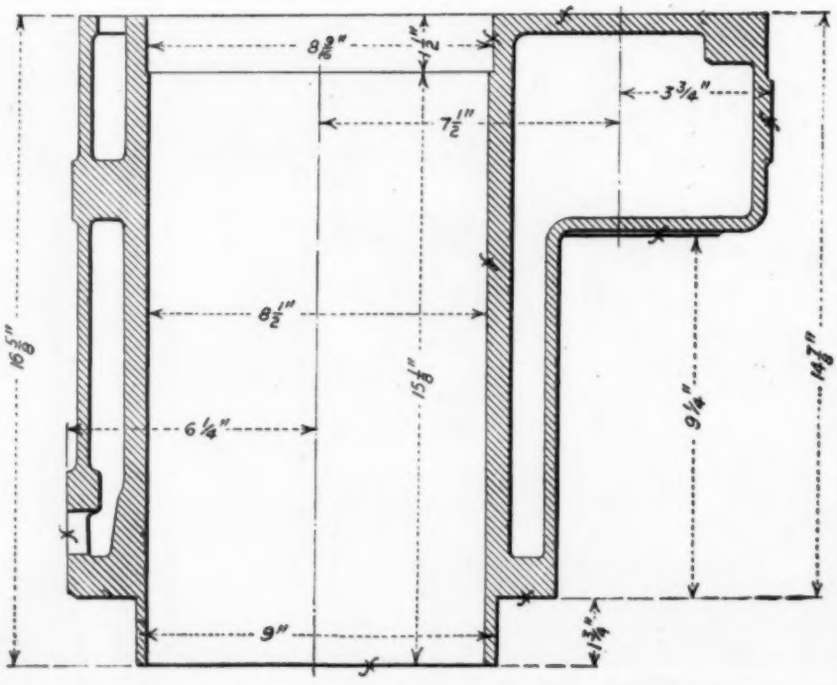


Fig. 4—Cylinder. Cast iron. Time, 41 minutes



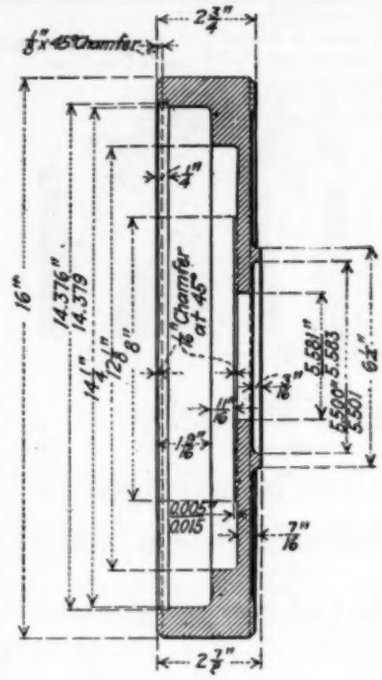


Fig. 5—Flywheel. Gray iron. Finish all over. Time, 12 minutes

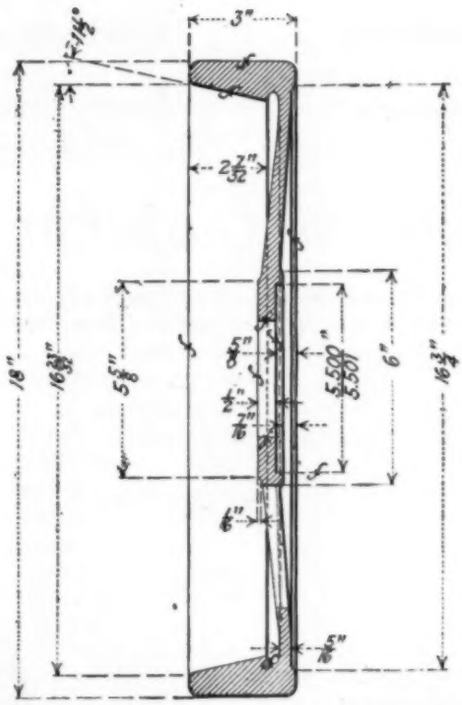


Fig. 6—Flywheel. Gray iron. Estimated time, 12 minutes

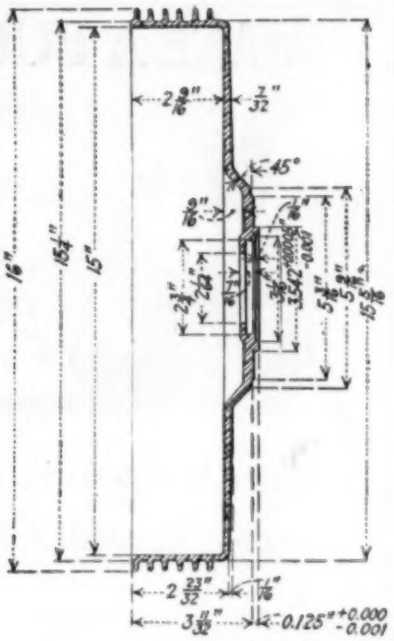


Fig. 7—Front brake drum. Steel forging 35 to 40 pt. carbon. Finish all over. Estimated time, 55 minutes

Fig. 8—Flywheel. Cast iron. Estimated time, 35 minutes

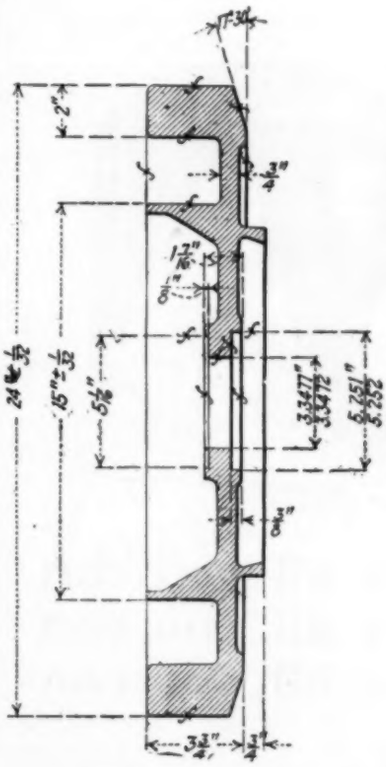
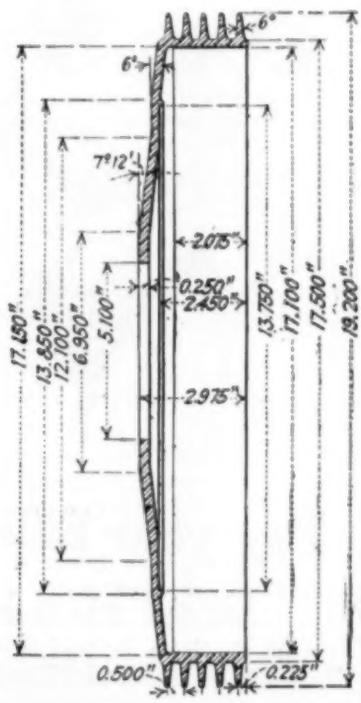


Fig. 9—Brake drum. Steel forging. Finish all over. Estimated time, 95 minutes

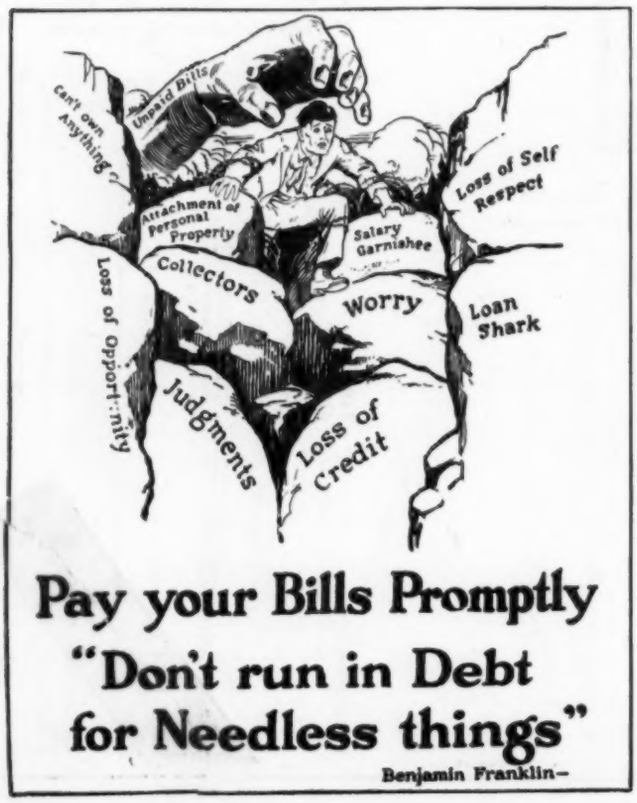


A Good Investment that helps one to Save
Savings or Building and Loan Association
And to Own ones' Own Home
Invest Wisely
Seek Safety First in Investments
Avoid Speculation in Wild Cat Stocks
"Money should be Used-not abused"
Samuel Smiles

Spreading the Gospel of Thrift

Some of the posters issued by the Y. M. C. A. for Thrift Week to illustrate the Ten Thrift Commandments

1—Work and earn
2—Make a budget
3—Keep a record of expenditures
4—Have a bank account
5—Carry life insurance
6—Make a will
7—Own your own home
8—Pay bills promptly
9—Invest in government securities
10—Share with others



John Dick Visits a Railway Shop

By F. M. A'Hearn

What he saw in the shop—Value of friendly outside advice —Locating machines for production—More ton-miles per shop-dollar—Results of progressive equipment inspection

AFTER Bill Weston, Jim Kelly and John Dick, Jr., had completed their apprenticeship at the Dick Pump Works, Weston and Kelly had gone from the "old homestead," as the three chums termed the Dick Works. John stayed with John, Sr., finally succeeding his father as manager. Kelly found the sale of machine tools an occupation to his liking.

Weston finally ceased his wanderings at Coaltown when he hired with the Coaltown and Great Western R.R. Years rolled on. In the changing cycle Bill found himself master mechanic at the main shops in Coaltown.

Although Dick, Kelly and Weston saw little of each other, the warm friendship of earlier years still existed. By chance Dick and Kelly were planning a hunting trip in the hills near Coaltown. Why not go around that way and induce Bill to be one of the party? Thus it was that one fine autumn morning found Kelly's car in front of Bill's office and Bill greeting his two former shopmates.

When shopmen meet, shop talk follows. When their lines are diversified, comparisons will ensue. When three men who were apprentices together meet again and discuss their work, frank and constructive criticism will follow shop talk. After a brief stay in Bill's office Dick commenced to fidget. Weston's invitation to come out to the shop was quickly accepted. Weston's frank way of pointing out the weak spots in Dick's management during his one visit to Dick's plant had proved an eye opener to Dick.

Weston Explains His Shop

Passing through the erecting shop on the way into the machine department, Dick stopped abruptly to examine the tram marks on the ends of the driving axles of a locomotive recently "wheeled." Seeing an apparent difference in the lines, he listened attentively while Weston patiently explained the squaring up of the wheel base to Dick's apparent satisfaction. One point that seemed to puzzle Dick was that errors were to be expected in old axles as the journal wear was always more rapid at certain points due to the alternate push and pull of the main rod being absorbed, at the same spot on the axle, at each half revolution of the wheel. Weston, as Kelly anticipated, led the party to the big driving-wheel lathe and proudly handed out chips that proved the machine a tool of ample power and strength for any service required. The lathe was idle, finished tires were in evidence throughout the shop. Weston explained that this part of the work was always away ahead and that double the amount of tires would not cause worry.

Dick next inquired how the driving-axle journal-truing job was handled. Weston explained that one of the old type wheel lathes was used for the job, but on account of the increased weight of the assembled wheels and the overhang of the center sleeves, the job had become rather awkward to handle. That the heavy counterweights produced an elliptic shape in the turned bearing, and that the unbalanced weights brought out the back lash in the drive, was plainly evident on a journal being turned in the old machine. Apparently this particular bearing had been cut to such an extent that the turning job could not be avoided. The fact that the slide rest was too short to traverse the entire length of the bearing at one setting did not prove an inducement to turn any bearings, unless the operation was an unavoidable one. Dick seemed particularly interested in watching the variation in the depth of the cut with each revolution of the axle.

The Planer Arrangement

The next stop was near a row of planers, the largest at the head of the line and the smallest at the opposite end. Each machine was located with regard to its size. The tools were all good, fairly modern, and were well cared for. One operator was facing a worn guide bar, another resurfacing a slide valve, a third channeling the sides of an I-section main rod, and another machining new driving-box shoes and wedges. Apparently all the planers in the shop were in the same group, as a miscellaneous lot of work, such as driving boxes, engine truck frames, and similar parts were piled nearby.

Passing a group of boring mills, Dick paused and looked at a front cylinder head on a machine.

A group of lathes, each lathe placed according to size, followed the boring mills. Kelly smiled as Dick asked Weston all about the piston lathe. The job of truing worn rods and rolling the turned surface with a hardened roller held in the tool post brought out additional questions. The fixture used in one of the machines for turning driving-box crown bearings was the subject of further inquiry and led the party some distance away to where the bearings were fitted to the boxes by machining the edges of the brass to fit against the offset of the driving box. Subsequent to this operation the boxes were transferred across the shop to a forcing press where the brasses were pressed into place. The boxes continued their movement by way of a drill press for plug holes, a planer to have the shoe and wedge faces surfaced, a trip to the brass foundry when new hub-face material was needed, and finally back to the planer for machining the hub face, concluding the movement at a boring machine where the crown bearing was machined for the journal fit.

The trip through the shop had been interesting. One could see that Bill Weston insisted on clean surroundings and a high standard of maintenance of the shop tools. The speeds and feeds were decidedly snappy on some of the machines. The work was arranged in an orderly manner and the absence of dirt or scrap was noticeable.

Back in the office again, Bill, feeling that he had made an impression on John Dick, of course wished to know what John thought of the shop.

Too Close to the Job

"Bill," he said, "you, Jim and I are the best of friends. I owe you thanks for showing me the rut that the Dick Pump Works occupied. Other men of less than your ability could have done the same. Possibly I would have resented their efforts, but I accepted your views and have profited. Why? Easy enough. You have built pumps, but you never managed a pump works. At first thought it would appear that my judgment should be better than yours in the matter of managing my own shop. Possibly true, but I was too close up to see things as I should. You classed some of the machine tools that I inherited from my father as thieves, robbers, and dry cows. I was mixing sentiment and tradition with business and was getting the per cent of business too low. It was hard to extract a good batch of dividends from the mixture I was using. I got out and looked around a few other shops that reflected prosperity. Then I saw a lot of things.

"The men in our shop were above the average, mostly property owners and steady men. Their ways were as we had taught them. If their gait was a little slow it was because they acquired it working with machines that had to be nursed to avoid damage. Plainly, we had no labor problem. We had a few good machines and a lot of poor ones.

"Naturally, in passing through the shop, I would admire the real producers. You first led us to the driving wheel lathe. You are proud of it, but that does not mean a thing except that it is out of step with the rest of the shop. If your tire turning troubles are history why think of them at all? Why not go after the unsolved problems?

"I learned that there were tools in use in America other than our old favorites, lathe, planer, boring mill, and drill. In most cases we now have fewer of these tools than formerly, although our business has doubled. We have put in some milling machines, grinders, a few turret lathes, and other special tools that are producers. When they cease to produce they will be handled as you advised to do with the old ones. That was the same as a hen not laying—off goes the head.

"We have the same management as before and the same men. We are doing an A1 business because we replaced a lot of junk with a few good, modern tools. These have enabled us to compete with others, and we can make money on jobs at a price that formerly spelled bankruptcy.

"Get this fact, Bill. Our greatest steel maker *did not keep obsolete steel plants running. He junked plants, machinery, or methods when they became out of date.*

"You know the results. The improvements always paid for themselves in a short time. Lower prices to the consumer, higher wages to the workman, and a good profit on the investment were the results of his action.

"Now take your shop. I don't know a thing about locomotives, except that they haul cars and are to be permitted to precede you when met at a grade crossing. I did not know the names of half the pieces we talked of today until you introduced me to them. However, I have learned a lot about machining operations recently. Just as you never managed a pump works, so I stand in the railroad shop, able to see things as a mechanic only.

"Those driving axle journals you don't turn, is that good practice? That locomotive looks like a big machine on a mighty poor foundation. If the lathe you have for the job is not worn out, but is too small, and not suitable, it is due for a move. I take it you feel that the bearings should be turned, but you are evading the issue until it forces itself on you. That spells trouble. I would not think for a minute that your only objective is to see how quickly that locomotive can be returned to service.

"If I understand things correctly, what you aim for is to do your work in a manner to secure the longest possible service term from the locomotive when it is placed in revenue service. If the tools that you have are brand new, but too small, they are of no more use to you, as an aid to attain your desired results, than some of the old ones I disposed of. We cannot depend on hand fitting to overcome machining errors, neither can we disregard growing evils.

"Those guide bars and valves you are planing; one good grinder would clean up as much work as three of your planers, beside saving a year's service metal that you take off to get under the hide. Nothing is wrong with your planers that I can see, nor with the operators either.

Saving Time and Machines

"You are simply wasting the time of good mechanics and wearing out machines doing work that should be done otherwise. Same thing applies to that job of turning and rolling piston rods. Say Jim, am I overstating this stuff?" Jim's negative reply started John anew.

"Big shops are milling jobs like that rod you were planing. If you could only see one of those big huskies eating its way to dividends you would swell up even more than you have over your pet wheel lathe, which is a real machine because it is built especially for one line of work and can do it right and fast. That shoe and wedge job, too; sure would like to see your planer compete with the milling machine that Jim sold the X. Y. & Z.

"Get him to send you some photos and records of the work they are getting out, Bill. He told me of it on the way up here. Say Bill, that cylinder head I saw on the boring mill; you face the inside surface of that? Yes? A joint to bear against the cylinder? A clearance outside the joint? Turn to a certain outside diameter and then face outside? Oh yes, you carefully size the diameter that projects into the cylinder too, I noticed. Why do you do that?"

"Well John," said Bill, "they look better and I always made them that way myself when I worked as a machine hand, although that cut across the inner face is not really necessary."

"What fits the outer diameter, Bill?"

"Nothing at all. A casing covers the whole thing."

"Well, then, what goes in front of the head?"

"Same casing, of course."

"Why is the outer face machined?"

"To give a bearing for the nuts on the studs that hold the head on the cylinder. Why do you ask?"

"One more question, Bill. Do you face the nuts? If not, you have some mysterious way of tapping them square with the flat face. I saw some on a cylinder out in the shop that were not faced and were not tapped square. That cylinder head looks to me the same as a blank flange to cover a hole, nothing more. A steam tight joint and some holes to go over the studs does nicely on a mine-pump cylinder-head finish. Why won't it hold on a locomotive?

"Those driving boxes; we saw you plane the hub face on one machine, and bore the bearing on another, without hub-facing facilities. Now that cylinder-head mill has two heads; you can bore and face boxes at the same time on that tool. Besides, you save the time of one set up.

Saving Labor Costs

"Say, Bill, a little study of some of these jobs like the cylinder head might cut your labor seventy-five per cent in some cases and release that mill for boxes. That would give you the time of the two operators now boring and facing. Properly arranged and useless work cut out, one man can do as much as three are now doing on those three machines.

"Those shop trucks and portable cranes for handling material are wonderful, but if you would group, for instance, your driving-box equipment in one place, you would have no use for the truck, except to bring the boxes from the erecting floor and to return them when completed. Go out there tomorrow and check up how many moves that box makes, and incidentally how far it travels each move. I saw one or two cases today where the machine hand was waiting for the truck too.

"Place your tools in such manner as to handle the work most conveniently. You don't need to have all your planers in one end of the shop and the lathes in the other, with the drill presses in their own select neighborhood. Forget the looks and place them for results. If you ask me, I would say to see where the material should be machined and then place the machines to suit.

"You have good buildings, good tools, and a fine lot of men in your shops. Now break loose from some of the traditions you are following and, if you have no good reason for certain practices that are obviously unnecessary, discontinue the practice; like the cylinder head, all that work to get a good bearing for a faced nut that wasn't faced.

"Do not wait for some other railroad shop to put in a certain tool first. The other fellow is probably waiting for the very same reason. He wants to see someone else try it. It may be possible, Bill, that you railroaders are a bit too conservative and cautious.

"Your position is identical to what my own was before I stirred things up, the only difference being that I was trying to put across twentieth century methods with nineteenth century tools. You have too many tools of some kinds, although they are nearly new. Others, you should have, are missing. When you think of additional machines, consider that, while an engine lathe is a wonderful tool, it is really asking too much to expect one, with no special equipment whatever, to make a respectable showing against a machine that you can set up for modern production. In other words, utilize special tools whenever possible.

"Another thing I have learned is this—buy a complete machine. You may save a little on a lathe without a taper attachment and tell yourself or your foreman that you can put that on any time. Did you ever do that? That planer on the shoe and wedge job for instance; even if you never had a chance to buy a miller, two heads on that cross rail and two side heads would put four heads to work. You are now using one. Think it over.

"Just because you are in a railroad shop is no reason why you should disregard costs. You fellows are not bidding on work like we manufacturers are, neither can you set the price of the transportation your road sells, but don't forget that the stockholder must have a square deal even if you never see him. You need not expect your superiors to tell you how to manage a shop. No doubt they look upon you as the best informed mechanical man in the state. You owe it to them to live up to their expectations.

"I am going to offer a suggestion, Bill. You let Jim show you what manufacturers are using in the line of machine tools, and see, for yourself, how many changes you could make that would amaze your railroad shop friends. Standardize your parts and get equipment for duplicate production if only in small lots. Jim and I will see you next week. Get your old rifle and load her for bear. Goodbye, Bill."

Really, according to Bill, the change wasn't bad. He had a few old tools that are now missing and has put in some new ones. He says he now scraps piston rods on account of defects only. Wear limits are forgotten, as grinding does not waste any service metal. Another new method he is proud of is carried out on a quartering machine when he trues up worn crank pins as well as bores pin holes. With this machine and his new journal turning lathe, he keeps pins and axles like new and can put rods and driving boxes up as they should be.

The Shop Rearranged

The engineer committee has ceased complaints about hard riders. There are none. The shop arrangement is different. He has all his driving box machinery spotted in one place, without regard to looks, or even to whether he can hang a countershaft. He says that motors are so much more convenient than belt drives that he is going to install them on all the tools as soon as he can. The driving box, and shoe and wedge jobs, that formerly annoyed him, are now close to the tire turning in the matter of speed. The whole line in the shop has speeded up to keep step with the leaders. Guides and crossheads must be ready, but grinding a guide is a small job. Motion work, too, is now made with grinding allowance after hardening, and as Bill says, "a one-armed man can throw the heaviest hand reverse gear we have, like nothing."

Bill says he has the world by the tail and a down hill pull, and from now on, output first, appearances later. Bill says that the shop looks just as good as when the planers and lathes were in neat rows likes bottles on drug store shelves. Besides that he is getting his "power" out faster and in better shape than ever before. That more ton-miles per shop dollar, and more ton-miles between shoppings, is what a motive power man should aim for, rather than the appearances his predecessor sought when he laid out the shops. Suitable equipment means a lot too.

Kelly confidentially remarks, however, that while he was at Bill's shop making a survey of the situation with Bill before he sold him a few real tools, he saw some places where Bill is losing money while he thinks he is making it. It may be worth while to stick around and see what Kelly is going to spring.

Ideas from Practical Men

Jig for Drilling, Counterboring and Trepanning

By Jack Williams

A simple and compact jig for drilling the spring collets of the "Positive Grip" chuck made by the J. M. Ney Co., Hartford, Conn., is shown in the accompanying illustrations. It is essential that all the holes in this collet be made in definite relation to each other, and a symmetrically shaped jig was preferred to a more elaborate indexing fixture. The work is done upon a 3-spindle sensitive drill press.

The jig is shown open in Fig. 1, with the piece before and after the operation at *A* and *B* respectively. The piece at this stage is a screw machine product, and the axial hole in the end that is to become the jaws of the collet is of one diameter, regardless of the nominal size to which the collet is to be finished. The large hole in the spring end is also of uniform size, and is reamed and chamfered.

A conical plug is permanently set in the rear end of the jig, upon which the chamfered end of the blank rests, and a smaller adjustable plug slides in the central bushing of the part *C*, being held in endwise position by a setscrew in the bushing. Part *C* attaches to the body of the jig by a sort of breech-lock. The blank is

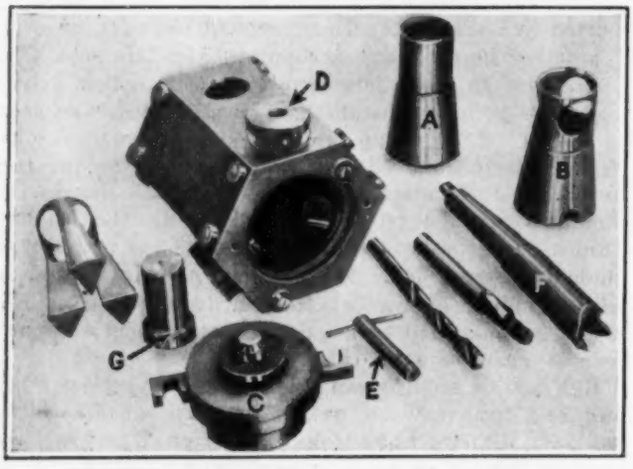


Fig. 1—Jig for drilling spring collets

held for drilling, therefore, between the centers formed by the opposed plugs. Fig. 2 shows the jig assembled for drilling the blank.

As the blank is symmetrical, all the setting that is required is to drop the blank into the open end of the jig and snap home the "breech-block." The first small hole is then drilled through the bushing *D*, after which the pin *E* is pushed through the bushing and into the drilled hole to prevent the blank from turning during subsequent operations. The second and third holes are drilled through slip-bushings which are identical with bushing *D* and can be used interchangeably with it. The permanent bushings are hardened, ground and lapped to fit the slip bushings.

When these three holes have been drilled, and before removing the pin *E*, the jig is moved under the second spindle of the drill press and the trepanning tool, or hollow mill, *F* is brought into use to cut out the first

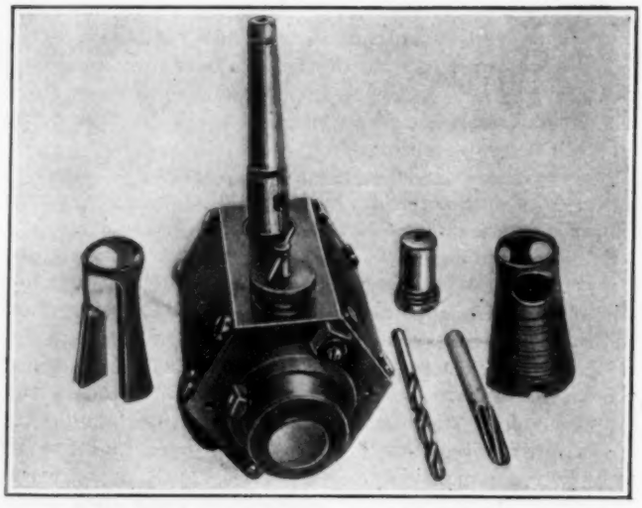


Fig. 2—Jig closed, with blank in place

of the large holes at the spring end of the blank. The plug *G* is then set into the hole, the pin *E* removed, and the remaining large holes cut out with the trepanning tool.

The slip bushings are then removed and the small holes counterbored while the blank is still in the jig. This is a matter of convenience rather than of necessity, for the counterboring tool is, of course, guided by its pilot and not by the jig. The counterbore is used in the third spindle of the drill press, being regulated for depth by the spindle stop.

Making Chuck-Jaws?—Discussion

By Robert B. Skinner

I was impressed by the thought of the false economy on the part of the company that purchased the "orphan" chuck told about on page 936, Vol. 61 of the *American Machinist*.

Had the company purchased a chuck manufactured by an established chuck maker, the price would probably have been less than that paid for the "orphan" chuck plus the labor and expense of making the jaws. Furthermore, if there should be a break-down, the cost of making the parts for replacement would be materially more than if interchangeable parts could be purchased from the chuck company.

It would be interesting to know the amount in dollars that is lost in similar so-called "savings."

IDEAS FROM PRACTICAL MEN

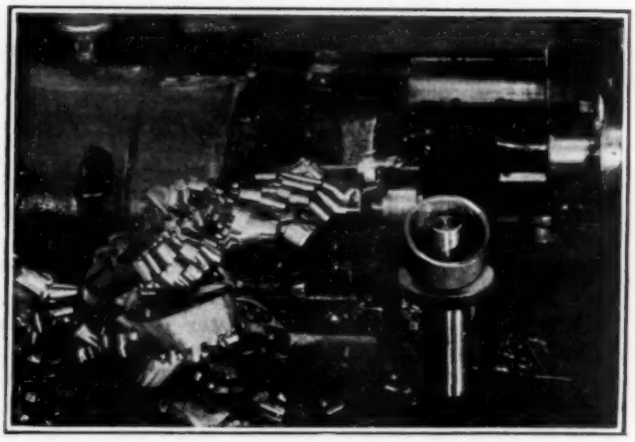
More Work and Fewer Chips

By William Denton

The capabilities of the automatic screw machine as a stock remover need no demonstration. Many a superintendent or shop foreman will point with pride to the huge pile of chips that is being carted away from some machine down the line and say, "Look at the stock that machine has hogged off this morning," or whatever time it may happen to be; as if he thought that the amount of metal the machine had removed was an accurate index of the number of useful pieces it had turned out.

Such an assumption is not necessarily correct. It depends much upon the shape and size, with relation to the bar, of the piece under production. It should be borne in mind that the making of useful product is the prime object of the screw machine's existence and that chips represent a possible waste of material. Perhaps, in cases where there is a considerable amount of stock to come off, the otherwise waste stock may be made to take the form of useful product.

In the illustration may be seen two pieces, a large shouldered stud and a sleeve, both made in one cycle of the Cleveland automatic upon the cross-slide of which



Making two parts at once

they are standing.[1] Instead of chewing off all the stock from the shorter shoulder with a form tool and throwing it overboard in the shape of chips, the outer diameter of the sleeve is turned and the sleeve "trepanned" from the bar by means of suitable tools in the turret. All the forming tool has to do with the sleeve is to cut it off, which it does at about the same time that it completes the cut on the other shoulder. A cut-off tool on the rear block of the cross-slide parts off the stud.

There are two of the trepanning tools, one on each side of the center of the work. One determines the inside diameter of the sleeve and the other the outside diameter of the shoulder of the stud. The width of each is so calculated that one cuts into the path of the other and thus removes all of the metal between the shoulder and the bore of the sleeve. The time is less than that required for the forming cut on the other end of the stud, so that production is not slowed up at all, and the sleeve therefore costs the shop nothing. If the stud was made in the ordinary way the time of making the sleeve would be lost time—or rather lost machine capacity—and the material of which it is made would be chips.

The stud and sleeve are both parts of a "style D" H. & G. diehead (though of different sizes) and are done so far as the machine can make them when they drop off the bar. The operation of making them is a regular one in the shops of their manufacturer.

Air-Blast for Cooling Cutters

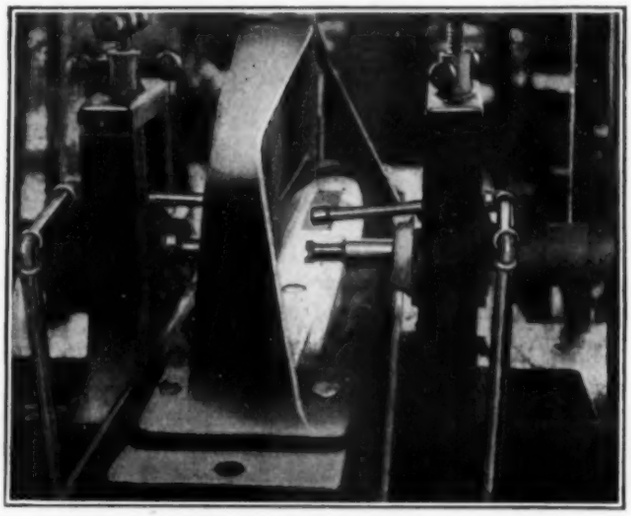
By Donald A. Hampson

Flooding cutting tools with oil or compound has been one of the leading factors in modern high-production work. Brass, cast iron and some other metals which are in the short-chip class present the exceptions to the rule, but even these can be cooled in most cases.

One instance where a liquid would not work satisfactorily was found in parallel milling cast-iron pieces on a duplex milling machine with opposed end mills. All lubricants and coolants tried had the effect of glazing the surface of the work and dulling the cutters; the net result being fifty per cent less work than when cutting dry.

Air was applied instead of liquids, and the results were better than expected. The pressure was 6 oz. per sq.in., which was found to be ample for cooling purposes and for carrying away the chips but not enough to spread the chips in a disagreeable manner.

On this particular work, pieces 20 in. long were cut. The friction of cutting and of the bearings caused the



Milling cutters cooled by air blast

spindles to increase in length so that the pieces were 0.003 in. smaller at the end of the cut than at the start. Air cooling completely removed this trouble. In piping the job, ¾-in. delivery pipes were used, increasing to 1¼ in. at the blower near by. The pipes were run so that they passed over the main spindle bearings and two holes at these points served to keep the bearings at uniform temperature, while the same number of holes at the cutter end of the pipe kept the tools, which run 250 r.p.m., from heating up.

IDEAS FROM PRACTICAL MEN

Plumb Bobs for the Machinist and Millwright

By E. F. Creager

I am afraid many readers of *American Machinist* will say, "why waste time in writing about such a homely device as a plumb bob when we already know all about it?" They will not even dignify it by calling it a tool, yet for many centuries the humble plumb-bob was an important item in the kit of any artisan.

With the advent of the spirit level-and-plumb the plumb bob has become more and more obsolete until at the present time only the mason and the surveyor consider it a necessary part of an outfit, and of these

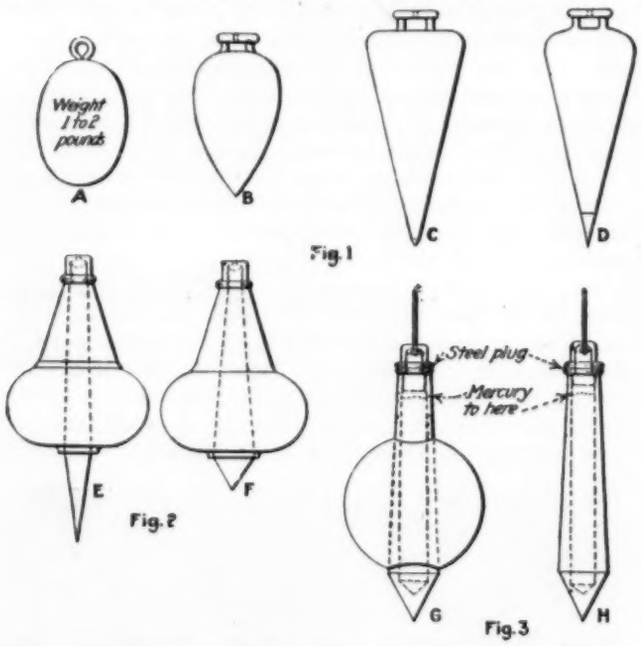


Fig. 1—Ordinary plumb bobs. Fig. 2—A better kind. Fig. 3—Home-made plumb bobs

only the surveyor appreciates the necessity for its accuracy. The average user is content with a brick bat, a large nut, or a piece of scrap iron, tied to any old kind of a string.

The lead weight *A* or the cast-iron bob *B*, Fig. 1, is the kind usually found in the kit of the first-class mason. The first is not machined at all, and about all the work done on the second is to drill a hole for the cord and grind off the casting gate. The drilling is more often than not "off-center." The latter fault may be found with the bob *C*, but as this one is polished and nickel plated it is frequently found in the millwright's kit. Being proportionately longer, the error of point location to center of suspension is greater.

I have upon more than one occasion seen this type of bob used for "point transfers" in setting up machinery, and it is not difficult to appreciate the amount of error that can be introduced. In a recent installation reported by one of our service men the foundation bolts for a 30,000-lb. machine were almost 7 in. out of the way from this cause. Unfortunately the bolts had been set and the concrete poured several days before the error was discovered, and the installation was delayed.

I tested the entire stock of this kind of bob carried by one dealer, by suspending them with braided fish-lines and carefully rotating them. The smallest circle described by the point of any one of them was $\frac{1}{8}$ in. and the worst example showed an error of more than $\frac{1}{4}$ inch.

The brass bob *D*, with either cast or screw-cap cord fastening and steel point, is the type usually to be found in the lower priced level and transit outfits. They are made in various shapes and are finished all over. The kind with the screw cap is the most accurate, but to my mind all of these bobs would be better if cast with the large end down.

The so-called "lamp bob," shown at *E*, Fig. 2, is one of the most accurate on the market. It is made of cast brass or bronze and has a taper hole through it that is fitted with a tapered steel pin for a center point. Very accurate layout or point-transfer work can be done with it. The shape, with the center of gravity so low, renders it very stable. It has the disadvantage that when it falls it almost invariably lands on the slender point, which is thus bent or sprung enough to destroy the accuracy of the tool.

After having one of this type of bob spoiled by a careless workman I remade it as at *F* by reaming out the hole and fitting it with a steel center, hardened and ground all over. This gave the advantage that the center could be knocked out and used alone for plumbing through a small hole or in cramped quarters.

I liked this bob so well that I made one as at *G* in Fig. 3, which is made from an ordinary lathe center and a steel ball. A hole, as large and deep as the shape and size of the center will allow, is drilled lengthwise in it, and is tapped at the open end to take a tightly fitting plug to which the screw cap for the cord is attached. Care should be taken to make the parts "line up," so that the point and the hole for the cord will be concentric. After the center is hardened and ground the hole is filled with mercury.

Happening to have a 2-in. steel ball handy, I annealed it and drilled and reamed a taper hole through it to fit over the center near the large end. This arrangement makes a bob with a low center of gravity, least surface presented to air currents, and of sufficient weight to keep the cord taut. In addition, it is easily separable, so that the loaded center, as shown at *H*, may be passed through a fairly small opening and used alone when necessary.

As for the plumb line, one usually finds a bob attached to any old piece of twine that is available and long enough. It is almost always of the twisted variety and is often full of knots. Why not use a piece of braided fish-line? The smaller the cord the better. Oiled silk is best; no fuzz, no twist, and close measurements are possible.

A piece of white card, punched and slipped over the cord, will give an excellent background for obtaining a sight with a transit. When working in dark places a light may be thrown on the card from a pocket flash-lamp. A piece of ground glass with the light behind and the cord in front of it is also a good expedient.

When working in windy places or when using an extremely long cord, use a heavy bob and suspend it in a bucket of water.

IDEAS FROM PRACTICAL MEN

Straightening and Turning Thin-Walled Tubes

By Arthur Silvester

The sketches show a method of straightening and turning thin-walled tubing, either steel, brass or copper, that I believe to be a good one. We had a large quantity of brass tubing 4 in. in diameter with $\frac{1}{16}$-in. wall, in 6-ft. lengths, all of which needed to be straightened, and this is the plan we adopted:

To locate the bends, a tube was first placed on centers in a lathe, using a hard-wood plug in the end next to

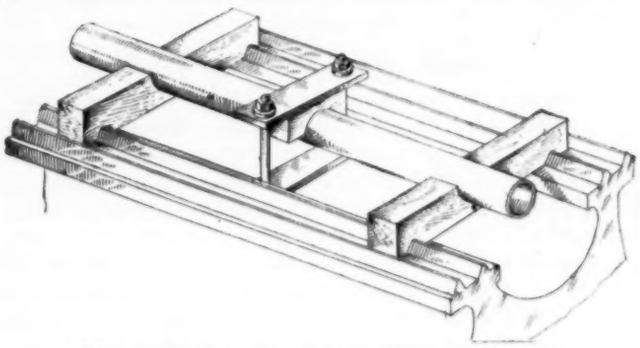


Fig. 1—Rig to straighten thin-walled tube

the headstock and carrying the other end on a running pipe-center in the tailstock. The high spots were marked in the usual way with scriber and rest. The marked tube was then placed on the hard-wood blocks

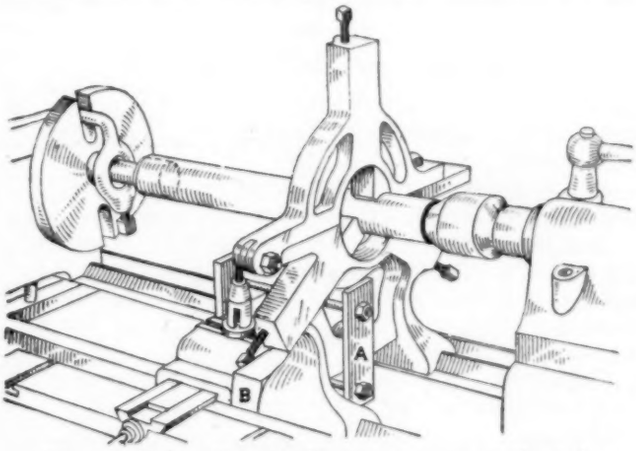


Fig. 2—Using the steadyrest to support the tube

shown in Fig. 1, with the clamp and pressure block over the highest part of the bend.

Before applying the pressure a surface gage was adjusted to the high spot of the tube to determine the amount of "set" given to the bend each time. The notches in the hard-wood blocks were nicely fitted to the radius of the tubes to prevent the latter from being bulged or flattened. After bending, the tube was again transferred to the centers to be tested for straightness.

After the workman had handled a few of the tubes he became more adept, and it was surprising how quickly and accurately he straightened the remainder. Two adjoining lathes aided in expediting the work.

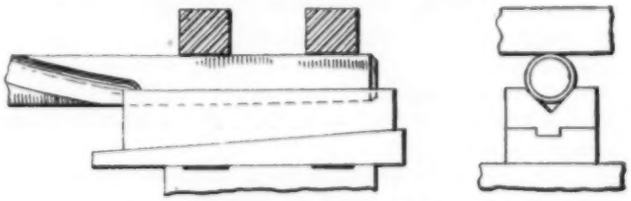
In turning the outsides of the tubes after they were straightened, the method shown by Fig. 2 was used.

A steadyrest was fitted with hard-wood jaws, and the clamp and bolt discarded. Straps and bolts as at *A*, Fig. 2, were used to attach the steadyrest to the lathe carriage with the block *B* between them. The three bearing points of the steadyrest—which became a followrest—supported the thin-walled tubing to much better advantage than the regular followrests usually furnished with lathes.

A Drillholder for a Lathe

By F. M. A'Hearn

In passing through machine shops we often have our attention drawn to misused tools, particularly twist drills. It is a common thing to hear the shrill sound made by a drill that has been ground off center, or one that is so operated as to bind while being fed into the work. This latter condition is often noticeable where a twist drill is clamped in the tool post of a large



A drillholder for a lathe

lathe and more or less makeshift methods are used to bring the center line of the drill approximately close to the line of the lathe spindle or centers. While no great difficulty presents itself in securing a fair horizontal setting, repeated shimming and tightening are often necessary to get the drill sufficiently near to the proper height to permit its use without serious trouble from binding and consequent side wear on the drill.

The use of a V-block and wedge as illustrated herewith will afford a satisfactory method of holding drills, collets, or round shank boring bars, where their use is required. By tooling a center for the drill in the face of the work and holding the drill in place by means of the tail center, the V-block and wedge may be easily adjusted to position and the tool clamps tightened.

The use of the same block in connection with round boring bars or boring tool holders gives an easy adjustment for top rake or clearance on the cutter, as a slight rotation of the bar in the block alters the cutting angle of the tool without changing the position of the bar in relation to the center of the work. This is a decided advantage over using forged boring tools. The frequent interference of the shank of the tool with the work in boring deep holes of relatively small diameter is avoided.

The department, "Ideas from Practical Men," is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for at space rates.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Turning Ball Ends on Shafts

Q. What kind of a tool should be used for turning ball ends on shafts? The balls must be round. I have tried a half-round forming tool but it does not make the balls round.

A. Any tool with a reasonably sharp point will do for turning balls, but it must be swung around the ball, the pivotal point being directly under the center of the ball. The tool must be set at the same height as the centers.

True balls cannot be turned with a half-round forming tool.

If you have only a few balls to turn, you can use your compound rest to swing the tool, by attaching a lever long enough to make the cut with ease. If you have many balls to turn, it will pay you to get a ball-turning rest for your lathe.

Facing Cast-Iron Pulleys

Q. What is the best method of finishing the faces of cast-iron pulleys?

A. The best method of finishing pulleys depends so much on conditions that it is difficult to answer your question satisfactorily.

If the pulley faces are very hard, the cheapest method will be by grinding. Pulleys having faces of 6 in. and under can be cheaply finished by milling, provided they are made in large quantities. Pulleys under 24 in. in diameter can be economically finished in a turret lathe fitted with the proper tools and attachments. Pulleys larger than 24 in. in diameter can probably be finished cheaper in a vertical boring and turning machine than by any other method, unless a regular pulley lathe is a part of your shop equipment.

Wood Floors on Concrete

Q. We would like some information in regard to concrete floors in the shop. In our building we have concrete floors covered with wood, but the wood rots from the oil with which it gets soaked.

Are bare concrete floors hard on the men and if so what is the remedy?

A. Concrete floors are exceedingly hard on the men who have to stand upon them and the arches of their feet are liable to be broken down, giving them what is known as "flat foot."

The rotting of your floors is probably caused by the moisture absorbed by the concrete, since oil will preserve wood. If a water-proof dressing, such as roofing pitch, is applied to the concrete before laying the wooden floor over it, the wood will last a long time before rotting.

Another way to prevent the decay of the wooden covering, is to partially imbed joists in the concrete when laying it, allowing the edges of the joists to protrude two or three inches above the concrete. The flooring can then be nailed to the joists. The space between the under side of the floor and the concrete will permit a circulation of air, thus preventing decay.

The joists should be tarred or creosoted before being placed in the concrete and the surface of the concrete should be coated with a moisture-proof compound.

Straightening Axle Shafts

Q. We are in the market for some sort of a machine for straightening axle shafts for automobiles. Can you tell us the best type of machine for this purpose?

A. The usual method of straightening axle shafts is in a punch press arranged with suitable supports so the pressure can be applied at any point desired. The supports are movable endwise of the shaft and are placed closer together to take out a short bend than for a longer one. Some method of graduating the pressure is necessary. Another part of the equipment is a pair of centers conveniently arranged so the shaft can be mounted between them and revolved to show where pressure is to be applied and also to indicate the effect of the stages of straightening.

Such machines, fully equipped can be had from the makers of shafting machinery.

To Demagnetize Boring Tool

Q. How can the magnetism be taken out of an engine lathe, so as to prevent the chips from sticking to the boring tool?

A. The magnetism is not in the lathe, but in the boring tool. The tool can be demagnetized by placing it in a coil of insulated wire connected to an alternating current. The tool should be moved backwards and forward and revolved within the coil. Be careful not to turn off the current while the tool is in the coil, as that will magnetize it.

Magnetism in cutting tools is hard to account for. A tool may become magnetized as soon as it is put to work.

What Spray Galvanizing Is

Q. What is meant by spray galvanizing?

A. Spray galvanizing is a method of applying melted zinc, copper, aluminum, or other metals to castings or forgings.

In general the process consists of feeding a wire of the spray metal through a hand tool known as a "pistol," melting the wire as it emerges from the feeding mechanism, and spraying it by compressed air onto the article to be coated.

The fine globules of the molten metal are shot against the surface of the article to be coated with such velocity as to imbed themselves into the pores.

Technical Abstracts

Organization for Better Foundry Practice

A survey of more than 50 foundries shows that organizations that plan carefully for proper distribution of responsibility, and for co-ordination of the several departments, are replacing foundries dominated by one man. Better results were observed when the working force and employer had a common responsibility for the success of the entire plant, than when an individual at the top concentrated all the power in himself. One-man domination was observed in 17 out of 38 smaller plants. The article relates an interesting transition from one-man domination to decentralized responsibility in a jobbing foundry, employing 110 men. The business grouped itself into seven major activities: first, selling; second, producing; third, purchasing; fourth, financing; fifth, accounting; sixth, employing; and seventh, maintaining plant. The owner originally controlled everything from his own head and consequently it was impossible for him to give sufficient thought to many important problems.

From a survey it was found that the foundry was best fitted for quantity production of small castings, and the equipment was gradually arranged for this purpose, interfering as little as possible with current production, and proceeding according to a prearranged layout of the plant. A pattern storage system was installed; control of patterns was placed with the pattern storage clerk; flask storage was systematized; raw material storage was arranged to facilitate the handling of materials. Departments were located to insure flow of materials with a minimum of handling, and a conservative policy guided all changes, so that the production system was kept working smoothly all the time. Costs were found during this period of change by supplementing the old cost records with later information necessary to give more accurate figures.

A chart is given showing the transition from the original system and the one now in use, and the article proceeds to state that foremen in turn may often profitably be relieved of detail by an understudy, recruited from the department and trained to take over responsibility by spending part of the time in supervisory work. In this way the several key positions in the plant may be covered with understudies gradually made familiar with the responsibility of supervision. — *The Iron Age*, Dec. 11, p. 1552.

Methods for Determining Cause of Failures of Gears

Paul Heymans, G. R. Brophy and A. L. Kimball, Jr., give a paper that embodies some of the results obtained by the authors through the scientific study of the stresses set up in metal structures, resulting from design and method of installation or assembly. This investigation applies specifically to the study of pinion gears. A brief description and discussion of the photo-elastic method of stress analysis is incorporated with reference to previous work done by the authors.

Through the use of polarized light and transparent replicas of the gears under investigation, it has been shown that a gear pinion is weaker than a plain circular ring whose outside diameter is equal to the root diameter of the tooth. It has also been shown that the highest concentration of stress when the pinion is put under uniform radial pressure, is beneath the center of the tooth. That is, the greatest stress concentration is at the point of the heaviest section of the metal rather than in the thinnest section between the teeth.

As a result of the photo-elastic method of analysis, predictions as to the form of failures were made and then substantiated by actual tests with steel gears.

The paper is too mathematical to abstract thoroughly, but the illustrations and text give a clear idea.— *Transactions of the American Society for Steel Treating*, October, p. 505.

Equipment and Maintenance in the Plant Yard

The maintenance of the various items of handling equipment used in the modern plant yard is an important part of the plant maintenance, and in as much as this equipment is subjected to the ravages of rain, snow, heat and cold, in addition to the ordinary depreciation due to the wear, it is logical to figure that it needs more attention than similar equipment inside the plant.

Unfortunately it is human nature to slight the maintenance of outdoor equipment in wet or cold weather. The roads in the yard are important links in the transportation chain and should be kept in good repair, similarly fences, sheds and other small yard buildings and all underground piping must be maintained in good condition.

Outdoor material handling machinery is often rough, crude looking equipment with large toothed gears and because of this fact, the equipment is not maintained properly. It is unfortunate that this is so, because without proper care the equipment cannot give the long service for which it was built. It should be considered as important as any other production machinery in the plant and given the same amount of care and lubrication.

In general, it is most important to take care of the power unit on all types of handling equipment, whether it be a motor gasoline engine or steam engine. If the unit is carefully taken care of, oiled and greased regularly and protected from the weather, it will give as good service as if it were indoors in the plant itself. A great deal of outdoor equipment is rendered useless each year due to rusting away. It should be painted at least once a year with a good wear-and weather-resisting paint. Before painting, the surface should be wire brushed and any rusty spots touched up with primer.

This article by William G. Ziegler and Matthews W. Potts is well illustrated. — *Industrial Management*, November p. 287.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

The Silver Jubilee of the Automobile Industry and What Is Behind It

THE 25th Anniversary of the Automobile Show in New York gives ample opportunity for much thoughtful reflection as to the changes that have taken place since the first show in Madison Square Garden and to factors that have made many of these changes possible. Study for example, the first Packard touring car, first advertised in 1902—a single-cylinder engine, short wheel base and no wind shield or top. A mere means of transportation, with little room in the tonneau and none of the refinements or comforts now found in the lowest priced cars.

Compare this critically with the Packard 6-cylinder car at the last show, not forgetting that the price of the old one-lunger was practically identical with the present price of a roomy sedan, carrying the same number of people in comfort. Note the amount of material in the present day car and its quality; study the amount and quality of the labor put in and then marvel that, with greatly increased prices of both labor and material, it is possible to give the customer so much more for the same number of dollars.

While there are many factors entering into the changes that have taken place during the first quarter century of the automobile industry, the one that has affected both quality and price to the greatest extent is the development and use of machine tools for the manufacture of cars in quantities that are almost unbelievable. Machine tool development and quantity output are the twins of economical production. Neither would have been possible without the other. The demand for cars in ever increasing numbers made it possible to devise new machine tools or to apply older designs more economically. On the other hand, without the newer machine tools and the careful study of new possibilities in machine tool performance, the large production, at decreased costs and increased interchangeability, would still be a dream instead of a reality.

The bicycle era may be said to have paved the way for automobile production on a large scale. For the bicycle played its part in the development of the automatic screw machine and the use of forming tools for heavy cuts, such as on bicycle wheel hubs. But the great appeal of the motor car to the buying public made possible many economies that could not be approached except by quantity production. The result is that a dollar now buys more material, more labor, and greater accuracy in the automobile than in any other product on the market.

It is this very fact that makes it difficult for the production man in the automobile plant to see why his dollar should not buy machine tools on the same basis. He has, however, but to compare the possible or probable market for the two products to see at once that the two cannot be considered from the same viewpoint. His machine tool equipment makes possible the production of astonishingly accurate, duplicate parts at a very low cost. And in many cases the machine is still turning out these parts after the first cars produced have found their way into the graveyard of automobiles.

The quarter-century anniversary of automobile manufacture is noteworthy in many ways. Its significance should be appreciated by all. But let no one overlook either the machine tool or the men whose intelligent utilization of machine equipment have made the present status of the industry possible.

The New Museum Deserves Your Support

THE National Museum of Engineering and Industry, an outline of which appears on another page, is an institution deserving the careful consideration of all who are engaged in either engineering or industry. Every civilized nation in Europe has a museum of this kind, some of them being over a hundred years old.

There is a notion in some quarters that museums are only for preserving relics and that relics are simply things that have served their time and have no place in modern society; that they should be junked the same as any old machine. In reality, however, we can learn much by studying the development of various machines and processes. Errors of judgment or lack of knowledge become apparent when we trace the development of machines. We can save repeating costly mistakes by knowing what has gone before. But museums go farther than that. They present to the student a concrete picture of the development of various industries in a way that is otherwise impossible. They show steps in processes that mean much more when seen than when read in dry description.

Every manufacturer and engineer should become familiar with the work of this institution, and on so doing, we feel that he will find it worthy of his support. A small body of earnest engineers are hard at work to make the new museum a reality in the near future. They deserve the help of forward looking men in all industries.

Shop Equipment News

Henry & Wright Variable-Speed Drilling Machine

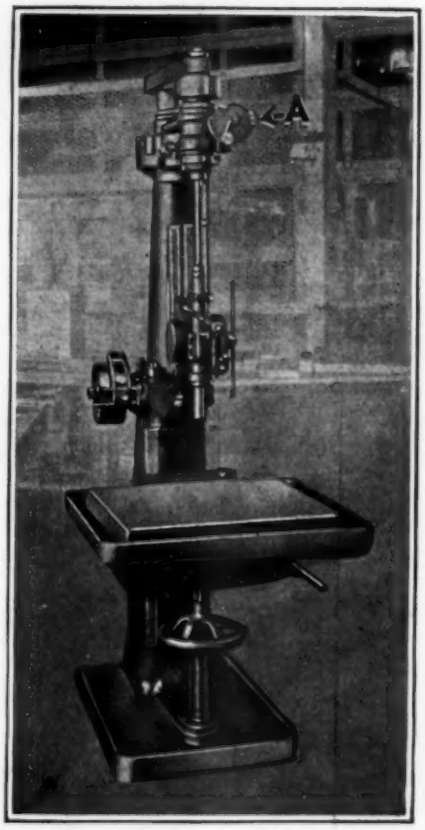
The Henry & Wright Manufacturing Co. of Hartford, Conn. has brought out a model of the "Viktor" drilling machine having features that distinguish it from other models.

The machine is adapted to either belt or motor drive, the motor being mounted by a special flange directly on the side of the column in place of the tight and loose pulleys of the machine shown in the illustration. The rotor shaft extends through the column, and at the center of the latter a helical bevel pinion is keyed to the shaft, meshing with a gear upon the lower end of the vertical shaft. A recess in each of the castings at this point forms a closed pocket in which oil is maintained at a level to cover the gearing.

From a two-step cone at the top of the vertical shaft a 2-in. belt drives a sleeve that is connected directly to the first member of the speed variator, of which the drill-spindle is the driven member. This variator is a device, developed for the Henry & Wright Manufacturing Co., by which the speed of the driven member may be altered from the slowest to the fastest by a single movement of the small lever *A* at the top of the bracket. The variation of speed is an even gradation, without steps, between the minimum and maximum limits.

The motor (or the driving pulley of the belt driven machine) runs at a constant speed of 1,750 r.p.m. With the belt in the position shown in the cut, the speed range of the spindle is from 900 to 2,700 and in the lower position from 300 to 1,000 r.p.m. Practically any speed within the respective ranges is available instantly without stopping the spindle or interfering with its movements. The feeds are taken off the spindle by a belt from a 3-step cone, and remain in constant relation to the spindle speeds, regardless of variation of the latter.

The feed may be continuous—drilling down to a stop, returning quickly to the starting point and repeating indefinitely without attention from the operator—or it may be set to release upon the completion of each cycle. In addition, a hand lever



"Viktor" Drilling Machine with Speed Variator

may be used to feed the drill or to return the spindle to the starting point.

The type of feed desired, full automatic, semi-automatic or hand feed, as well as the feed engagement and release, are obtained from a single control-handle placed for convenience on the front of the arm.

Features claimed for the machine in addition to ease of speed control are: rigidity; power; absence of vibration, and economy of floor space. As there are no protruding countershafts and there is no occasion to go behind the machines, a gang may be set back to back and table to table to save floor space.

The machines are made with one, two, three or four spindles. The spindles are $\frac{7}{8}$ in. in diameter and have a No. 2 Morse taper hole. Ample power is provided to drive drills up to $\frac{3}{4}$ in. in diameter. The table of the single-spindle machine has a working surface of 16x16 in. on a 8-in. overhang, or 24x24 in. on a 12-in. overhang and is surrounded by a channel to carry off the drilling compound.

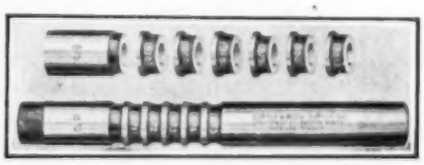
The table has a vertical adjustment on the column of 21 in., and the rack movement of the spindle is $6\frac{1}{2}$ in. Maximum distance from spindle end to table surface is $27\frac{1}{2}$ in. A geared pump is attached to the base of the machine and driven by belt from the main drive shaft. A tank for the compound is enclosed within the base of the column.

The net weight of the single-spindle machine is 920 lb. and the floor space occupied is 22x32 inches.

Cutter & Wood Supply Co. Interchangeable-Cutter Broach

The Cutter & Wood Supply Co., 274 Friend St., Boston, Mass., is putting on the market a broaching tool made up of a number of cutters, any of which may be detached. The tool is known as the "I. C. Broach."

The tool is intended for use in repair shops and service stations in broaching connecting rods, piston-pin bushings, steering knuckles, pulleys, gears and bushings. It will



I. C. Broach

broach any intermediate-sized hole by 0.001-in. steps between the standard broach size and 0.006-in. oversize, inclusive.

The nominal sizes of the broaches

SHOP EQUIPMENT NEWS

vary from a diameter of ½ in. up to and including 1½ in. by steps of ⅛ in. A special broach, 0.735 in. in diameter, known as the "Ford-size," is also manufactured. Extra cutters for increasing the range of the broach from its nominal size to ⅛ in. or 0.016 in. oversize in steps of 0.001-in. can be furnished.

The illustration shows the construction of the broach. It is assembled for broaching a hole ⅞ in. in diameter. It is comprised of a body, a pilot and five cutters. The equipment includes an extra pilot and six extra oversize cutters.

Bullard 8-inch 4-Spindle Mult-Au-Matic

To take care of those manufacturers whose requirements are not sufficiently exacting to warrant the use of the 6-spindle Mult-Au-Matic, the Bullard Machine Tool Co., Bridgeport, Conn., has brought out the 4-spindle model shown in Fig. 1 to handle pieces up to 8 in. in diameter. It is designed on the same

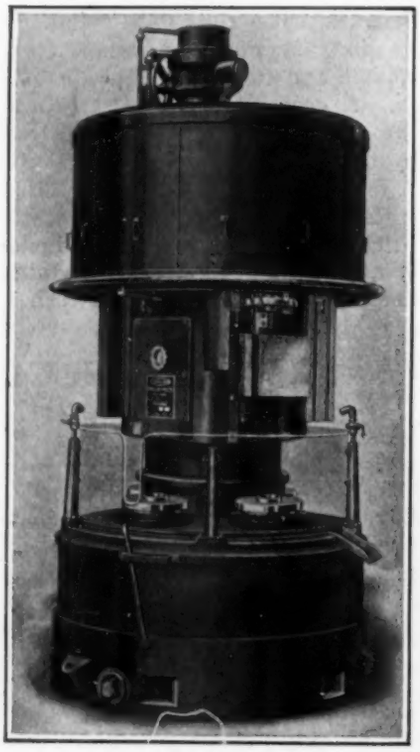


Fig. 1—Bullard 4-Spindle Mult-Au-Matic

lines as the larger machine, operates on the same principles and uses many of the same parts.

The four work spindles mounted on the carrier occupy in succession one loading station and three work stations, symmetrically spaced around the column. There are no tools at the loading station and the spindle is idle at this station for unloading finished work and for chucking the rough piece. Each working station is provided with a universal tool carrying head which may be set independently in rate of speed and in direction, amount and rate of feed. Total movement of the main head is 6 in. in a vertical and 3 in. in a horizontal or angular direction. The rate of speed varies from 0.0067 to 0.060 in. and may be set independently for each head. Where additional tool capacity is required a supplementary side head may be mounted at any or all of the work stations. As shown in Fig. 2 the side head is mounted on a bearing provided on the central column and is braced by an arm extending across the column face. When a side head is installed at any station the main head is limited to vertical feed only.

Vertical adjustment of the side head is permanently set by hand. It will take horizontal, vertical or angular cuts, the amount of traverse

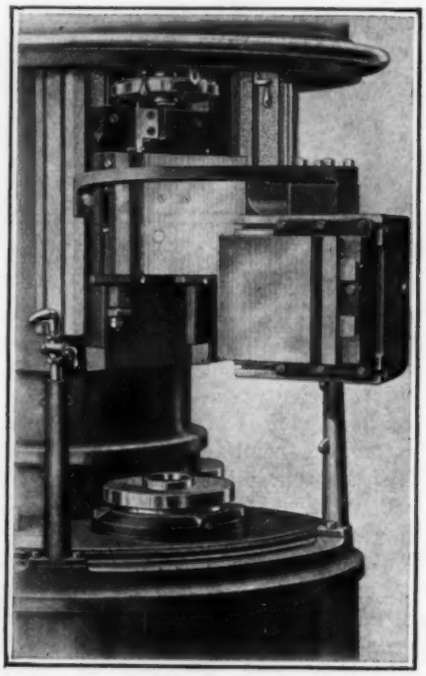


Fig. 2—Arrangement of supplementary side head

varying from 3 to 6 in. The rates of feed and rapid traverse are in direct relation to the main head at the same station at ratios varying from 1:1 to 1:3.

The cycle of operations begins with the indexing of the carrier and the presentation of new work at each station. All tools then advance at a constant rate of rapid traverse until the predetermined point is reached where the rapid traverse motion is tripped out and the feed is engaged. Upon completion of the work the tools are retired by rapid traverse and the indexing mechanism is tripped to repeat the cycle.

The spindle speeds can be set independently for each station at from 33 to 300 r.p.m. The spindle head is 9¾ in. in diameter and mounts a 3-jaw universal chuck 10 in. in diameter that will grip an 8-in. piece. The swing in the clear is 12 in. in diameter and 6 in. in height. The main drive pulley is 14 in. in diameter, has a 4½-in. face and runs at 760 r.p.m. A constant-speed, 7½-hp. motor running at 1,200 r.p.m. is required. The floor area covered is 67 in. in diameter and the machine is 128 in. high.

Leitz Micro-Metallograph —Model 1924

E. Leitz, Inc., 60 East 10th St., New York City, has recently added to its line, the Micro-Metallograph—Model 1924, as illustrated herewith.

The apparatus is a combination microscope and camera and is intended for use in examining and photographing metals and other objects.

The microscope is of the inverted type and is equipped with an object stage, a vertical illuminator, an arrangement for oblique illumination, and an automatic arc lamp. A mazda lamp having a solid strip of tungsten can be furnished if desired. Achromatic, apochromatic and fluorite objectives can be supplied.

The camera has a bellows length of 100 cm. and the bellows have a light-tight connection with the microscope.

The apparatus is mounted on a table, the legs of which are provided with ball casters and leveling screws. A vibration absorber is included in the mounting.

Both the camera and microscope

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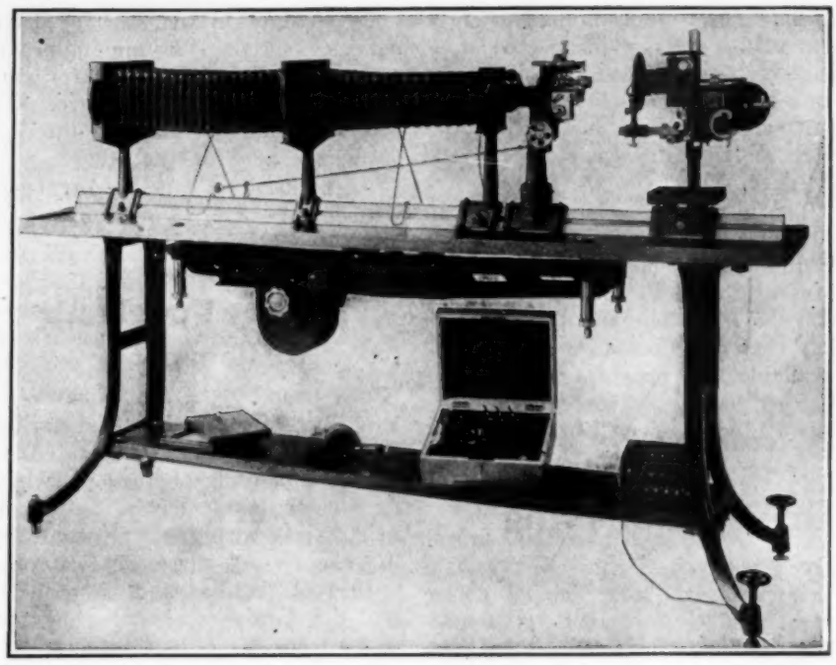


Leitz Micro-Metallograph—Model 1924

slide on an optical bench, consisting of a triangular track of cast iron, carefully machined.

A special apparatus for illumination by transmitted light, an attachment for photographing large specimens, and various accessories can be furnished.

Da Costa Pneumatic Gravity Drop Hammer

The Pneumatic Gravity Hammer Co. of 261 Franklin St., Boston, Mass., is putting out a gravity, or drop, hammer in which the lifting device is a pneumatic cylinder mounted directly over and in line with the hammer head.

The head slides upon two round steel rods, accurately ground to uniform diameter. The sliding bearings are shouldered bronze bushings, two on each side of the head, forced into correspondingly counterbored holes in the head casting and line-reamed with the base and the tie-bar at the top of the guide rods to insure an accurate fit over the length of the stroke.

An enlarged shoulder at the lower end of the piston rod sets into a cavity in the head and is confined between two rubber bumpers, so that the shock of the blow is relieved and does not tend to crystallize the rod. It is retained in the head by means of a breech-lock device that eliminates the necessity for setscrews or cap bolts. The machine is designed to avoid the use of screws and bolts at critical points, to prevent trouble from such parts jarring loose.

The air cylinder is a brass tube, having a length equal to the full height of the drop and a diameter so calculated in relation to the available air pressure as to make the hammer respond quickly to the movements of the controlling valve.

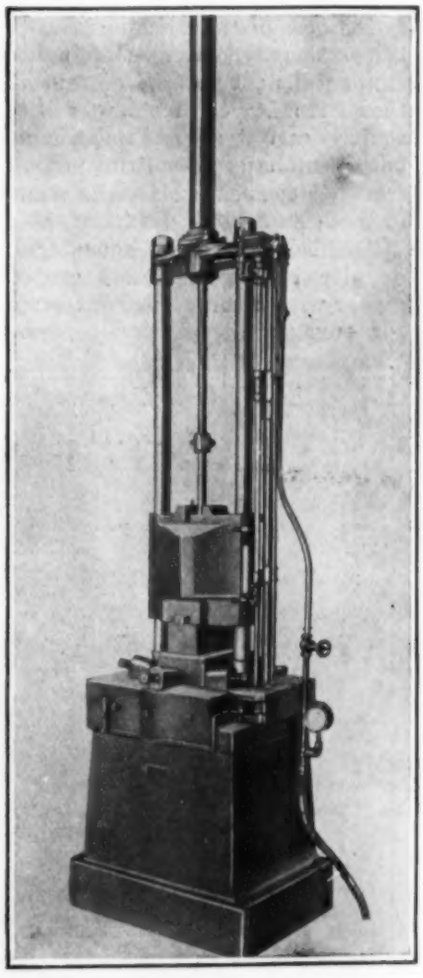
The movement of the hammer head is controlled by a semi-rotary valve in the air inlet, and this valve is actuated by a round rod extending downward alongside the head and fitted with cams, or dogs, which are struck by a projection on the head and cause the valve rod to make a partial rotation.

The cams are splined to the valve rod but are not otherwise attached to it. They are supported by brackets that are vertically adjustable upon a rigid bar that extends from the base of the machine to the tie-bar, behind the valve rod. The shock of the blow from the hammer is thus sustained by this bar and not by the rod.

The height of drop is regulated by adjusting the upper cam up or down upon its supporting bar. A clamp collar on the piston rod is at the same time adjusted to come in contact with the tie-bar at the top of the stroke and prevent the hammer from overrunning from the momentum of the parts and expansion of the air.

A small by-pass in the operating valve permits sufficient air to enter the cylinder when the valve is closed to overcome any slight leakage that may exist, and thus pressure is maintained to keep the clamp collar tightly against the tie-bar and prevent any "jockeying" or vibratory movement of the hammer at the top of the stroke.

The operating valve is manipulated by a lever at the right-hand corner of the base. When the drop is in normal operation this lever is interlocked with a bolt that is under control of the crank handle at the left, so that the hammer cannot be dropped except by the simultaneous use of the operator's hands at widely separated places, thus constituting an effective safety device. The valve



Da Costa Pneumatic Drop Hammer

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mechanism may also be so set as to allow the hammer to operate automatically and continuously if desired.

By means of a secondary valve the hammer may be released, stopped, raised, or held indefinitely in any position between the extremes. In this setting the machine is as flexible as a steam hammer, and a skilled operator can use it to strike light or heavy blows as desired. This feature is particularly valuable in connectioin with "hubbing in" new dies.

A check valve in the supply pipe prevents the backward escape of air, so that if the supply is inadvertently cut off—as by the unexpected stoppage of the compressor or other reason—the hammer will not drop, but will settle very gradually upon the dies as the air leaks out of the cylinder.

The machine can be furnished in 100, 200, 500 or 1,000-lb. sizes. It is intended to operate upon an air pressure of 80 lb., but the cylinders may be interchanged to adapt it to any reasonable pressure that may be available. A pressure variation of ten per cent either way will not seriously affect its functions.

Geier Electrically-Driven Polishing and Buffing Lathe

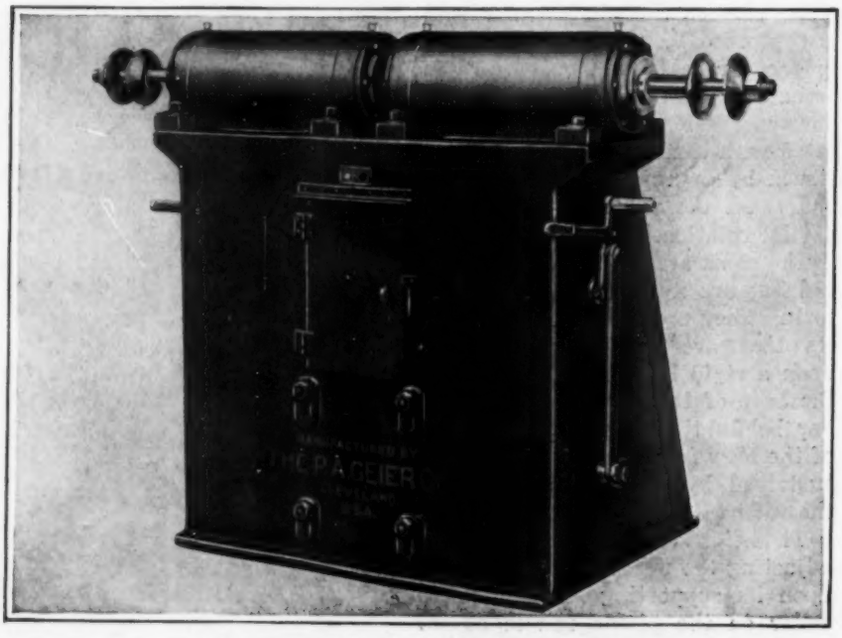
The P. A. Geier Co., Cleveland, Ohio, is marketing the electrically driven polishing and buffing lathe, illustrated in the accompanying half tone.

The base of the machine is of the box-section type and contains the motor, idlers, brake mechanism and the control box. The motor is of the squirrel-cage type and is mounted on a sub-base, permitting adjustments to compensate for the stretch of the belts driving the spindles.

The belt idlers are mounted on annular ball-bearings and are, together with a counterweight serving for engagement purposes, operated by a hand lever located on the outside of the machine. The same lever acts, when required, on a toggle-brake lined with raybestos, to stop and lock the spindles.

The spindle head is of one-piece, cast-iron construction. The 2¼-in. spindles are mounted on annular bearings, and are kept dust proof by a system of dust baffles. The spindle housing is enclosed in a sheet-metal hood for dust protection.

The electrical control is enclosed in a separate case fitting within the body of the machine. Power is controlled by push buttons on the front and near the top of the machine.



Geier Polishing and Buffing Lathe

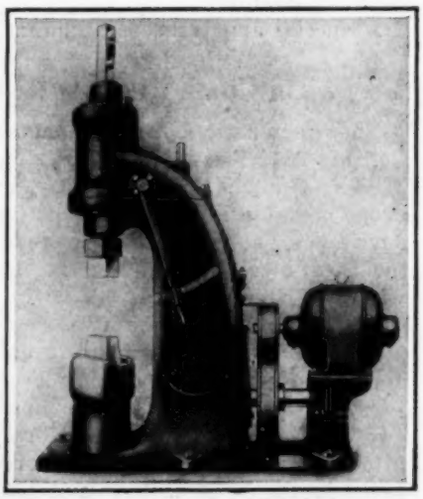
By changes in the sizes of drive pulleys, speeds varying approximately from 1,800 to 3,000 r.p.m., may be obtained. If desired the speed on one end may be different from the speed on the other.

This machine can be furnished with motors of 5, 7½ or 10 hp. 4-in. endless belts are used.

Beaudry Upright Air Hammer

The Beaudry Co., Inc., Parkway at Vine St., Everett, Mass., is marketing an air hammer illustrated on the accompanying photograph, which is belt or motor-driven, and made in six sizes with from 100 to 1,200-lb. rams. All sizes are equipped with foot treadles and hand levers and can be operated either by foot or by hand.

The anvil is separate from the main frame casting and is supported upon its own foundation in order to eliminate shocks to the hammer



Beaudry Upright Air Hammer

frame. When equipped for belt drive no countershaft is necessary as the hammer has a tight and a loose pulley, the belt being shifted to the loose pulley only for long stops. The blow is positively regulated by the foot treadle from a light, sensitive tap to the heaviest blow, the ram being held suspended when not working or clamping the work for bending.

The greater part of the ram's weight is concentrated in a bar of large sectional area passing through both cylinder heads. The ram head

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is fixed to the bar by a wedge-clamping ring and is readily removable when desired.

In operation the compressor piston in ascending compresses the air above it. This air flows into the ram cylinder, sending the ram upward with great speed. When near the top, a certain amount of air trapped forms a cushion which causes the ram to rebound. This action combines with the suction of the now descending compressor piston and the ram's weight causing the ram to strike with great force upon the work.

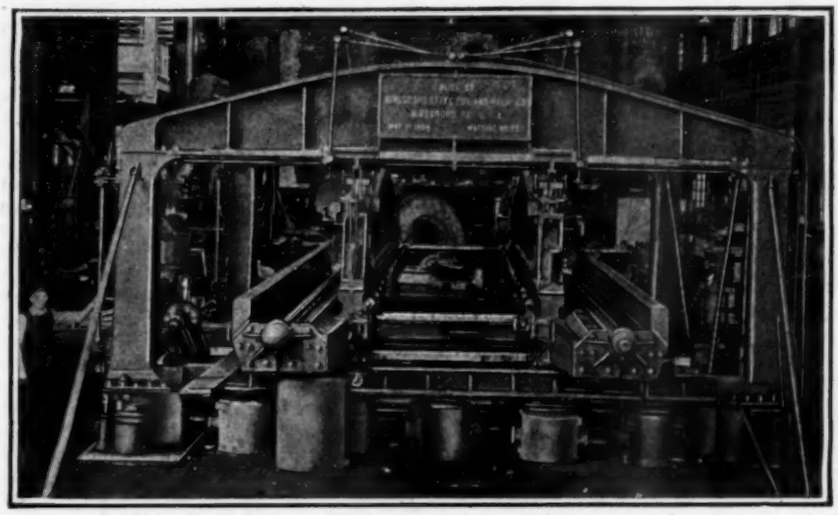
The number of blows per minute is 220 in the smallest size of hammer and 110 in the largest size, for work of an average size of 2½ and 8 in., respectively. The total weight varies, according to the size, from approximately 5,000 to 34,000 lb. The corresponding motors vary from 5 on the smallest to 40-hp. on the largest size.

Birdsboro Plate-Planning and Upsetting Machine

A special planing and upsetting machine built by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has recently been installed and put in operation at the Leetsdale plant of the Riter-Conley Co. This machine is used for planing and upsetting the edges of plates used in making lock bar pipe. In general, the procedure in making lock bar pipe is to take the plates as delivered from the mills, generally in lengths of 30 ft., plane the edges and upset them by means of rollers. The plates are thereafter bent to the proper radius and the upset edges joined with a specially rolled lock bar. This bar is pressed together over the upset edges, making a perfectly tight joint.

The machine consists of two main beds 45 ft. long, carrying the lead screws and carriages. Each side of these beds is formed into a beam on which the plates rest. Above the beams are supported two heavy clamping beams, each 32 ft. long, which by means of hydraulic pressure of approximately 100,000 lb. at each end of the beams, securely clamps the plates for the full length of the two edges that are to be planed and upset. The clamping beams are in turn supported by two overhead crossbeams resting on columns.

The two lead screws are 6 in. in diameter, with triple threads, and are connected by bevel gears to a common drive shaft, driven through a Falk reduction gear unit by a 200-hp. motor. Each carriage is provided with a tool holder, holding six cutting tools, and a holder for eight vertical upsetting rolls. In front of the carriage is a pushout bar, by means of which the finished plate is pushed out of the machine, and in the back of the carriage is a clamping device by means of which the unfinished plates are gripped and moved into the machine.



Birdsboro Plate-Planing and Upsetting Machine

The plates vary in width from 30 in. to 12 ft., which made it necessary to have the main beds and clamping girders adjustable to this extent. For this purpose, the main beds are placed on five shoe plates, provided with tee slots on which they can slide, and are bolted down after adjustment has been made. The clamping beams have similar adjustment, but are supported and slide on the lower flange of the overhead crossbeams.

The adjustment is accomplished by means of four single thread screws connected by bevel gears to a common drive shaft, driven by a 10-hp. motor. As the two edges of the plates used in lock bar pipe are not parallel, due to the fact that one end of the finished pipe section must be of smaller diameter than the other end, so that one section of pipe can fit into the other, the main beds and clamp girders must have individual adjustment at both ends. For this purpose the shaft driving the cross screws is provided with two jaw clutches, each one of which can be thrown in and operated individually, or both in unison. To guard against overtravel there is a differential limit switch, furnished by the Electric Controller & Mfg. Co. As an additional safeguard, the drive gear is of the slip ring type, so as to slip in case of heavy overload.

The main beds are 45 ft. in length, each made in three sections. These sections have the ends planed and crosskeyed, and are held together by heavy bolts. The machine is of steel construction throughout, due to the heavy loads encountered. It is stated that tests showed that to upset the edge of a ½-in. plate required a pressure of approximately 400,000 lb. In addition to the side pressure on the main beds, there is a considerable stress from the cutting tools. It is sometimes necessary to remove as much as 2 in. of stock from each of the two edges which is done by the six cutting tools, simultaneously with the upsetting. The entering and discharging of plates in the machine is done automatically on the return stroke of the carriages.

The speed of the carriages is from 25 to 35 ft. per min., depending upon the thickness of plates being upset.

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It is claimed that the time required to plane and upset a 30 ft. long plate, floor to floor, is 2¾ minutes.

The plates enter the machine at one end, resting on a roller table and castors. Castors are also placed between the beds for support of the plates. After being finished, the plates are pushed out of the machine onto another roller table and from there removed by overhead magnet. For convenience of the operator, the carriage has been provided with a platform on which he can ride.

The main motor is with a screw limit switch, furnished by the Electric Controller & Mfg. Co., which limits the travel of the carriages and automatically stops them at end of the stroke. A rod running along the side of the clamping beams within easy reach of the operator, connects to the starting switch, thereby making it possible for the operator to stop the carriage from any position.

Hermas Machine Co. now Making "Locator"

The Hermas Machine Co., Inc., Hawthorn, N. J., has purchased the patent and manufacturing rights to the "National Locator" formerly made by the National Tool Engineering Co. of Cincinnati, Ohio, and described in the *American Machinist*, Volume 61, page 1018. The "Locator" will be manufactured in the Hermas plant.

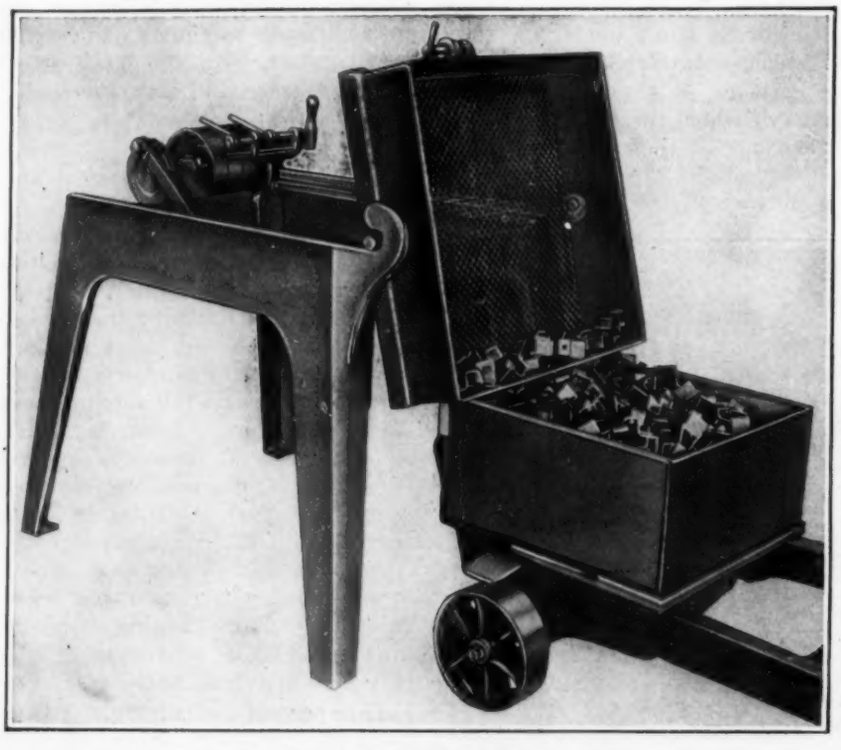
The "Locator" is used for the laying out, drilling and boring of small and medium-size jigs.

The Sanford Chip Separator

The F. C. Sanford Manufacturing Co., 2060 Fairfield Ave., Bridgeport, Conn., has recently placed on the market the chip separator shown in the illustration.

The machine is intended for use in connection with an oil separator and is used to separate the product from the chips after removal of the oil by the separator.

The shaker box is 24x24x6 in. The connecting rod is attached to the box by a removable bolt, thus making disconnection easy when dumping the chips from the box. Three screens are furnished, having meshes of ¼, ½ and ¾ in. respectively. The screens may be used separately or in combination. Room is provided underneath for a container to catch the screened chips conveniently.



Sanford Chip Separator

Machinery Buying by Italy and Japan Is Gaining

Despite all that has been published to the contrary recently, available statistics secured in Italy and Japan indicate quite clearly that the American machinery manufacturer is in a better position in the world's markets than ever before, according to the Industrial Machinery Division of the Department of Commerce.

In *Commerce Reports* for Dec. 1, 1924, an article was published based on the experience in Italy during the past two years which showed that the low exchange countries were no longer securing as large a proportion of the machinery imported into Italy as had been the case in 1922, while high exchange countries, such as the United Kingdom, and the United States, had succeeded in increasing their participation in this business, the volume secured for the United States having been quadrupled when compared with the experience of two years ago.

Data has just become available which provides a striking confirmation of the conclusions previously drawn from the experience in the Italian market.

It will be noted that, although Great Britain furnished over 67 per cent of the machinery imported into Japan in 1910, and that this participation did not fall below 54 per cent in the pre-war period, British interests have not been able to recover anything like this participation since the trade was interrupted during the war. The best record attained was that of 1921, when it was slightly over 41 per cent.

Germany's Poor Showing

From time to time newspaper and magazine articles intimate that Germany in pre-war days was peculiarly successful in the world's machinery trade, and as the result of the collapse of the mark has had exceptional advantages in the period since the war. It is consequently particularly interesting to note from these Japanese statistics that at no time has Germany furnished more than 25 per cent of the machinery imported by Japan. This participation was greatest in 1913, and since the Armistice German interests have not been able to secure as much as 10 per cent of the machinery business of Japan.

In contrast to this, it is gratifying to note that, although the United States furnished less than 20 per cent of the machinery imported by Japan in the pre-war period, our interests have been able to increase this participation and during the war period, when European sources of supply were cut off, furnished as much as 78 per cent of Japan's requirements. Naturally, this has declined somewhat since the close of the war, but even in 1923 the participation was over 41 per cent, or more than double the pre-war position. This is the more significant as the volume of the machinery imports into Japan has greatly expanded during the period.

News of the Week

George Merryweather Is Elected Head of Newly Formed Dealers' Association

Cincinnati meeting enthusiastic for separate organization

The formation of the Associated Machine Tool Dealers was effected at a meeting of fourteen representative distributors from all parts of the United States that was held at the Business Men's Club, Cincinnati, Ohio, on Jan. 12. Admission to the new organization will be restricted to machine tool distributors with exclusive agencies who are able to carry their own accounts.

In creating the new association the delegates at the meeting in Cincinnati felt that machine tool dealers could function more efficiently than they have in the past if they had a separate organization of their own. This is due largely to the fact that many dealers do not handle supplies and, therefore, are not directly benefited by much of the work being done by the National Supply and Machinery Distributors Association.

George Merryweather, of the Motch & Merryweather Machinery Co., Cleveland, was elected president of the newly formed association. Other officers chosen were: Marshall Prentiss, of Henry Prentiss & Co., Inc., New York, vice-president; Tyler W. Carlisle, of the Strong, Carlisle & Hammond Co., Cleveland, secretary; and George Cherrington, of the Brown & Zortman Machinery Co., Pittsburgh, treasurer. The executive committee will consist of Charles Bush, the C. A. Strellinger Co., Detroit; J. W. Wright, the Colcord-Wright Machinery & Supply Co., St. Louis; J. R. Van Dyck, the Van Dyck-Churchill Co., New York; Roy Porter, the Marshall & Huschart Machinery Co., Chicago; W. J. Radcliffe, the E. A. Kinsey Co., Cincinnati; and L. H. Swind, Philadelphia.

Although no definite arrangements have been made about the first annual meeting of the Associated Machine Tool Dealers, indications favor a meeting in May at the same time and place as the convention of the National Supply and Machinery Distributors Association.

The constitution and by-laws of the association are in the process of formation at present and will soon be made public.

Officers have given assurance that the new organization will work constantly in co-operation with the National Supply and Machinery Distributors Association.

Steel Treaters Meet in Cincinnati

The winter sectional meeting of the American Society for Steel Treating was held in Cincinnati, Ohio, Jan. 15 and 16 at the Hotel Sinton and the attendance was the best that has been recorded at one of these sectional meetings. Not only were there present members of the Cincinnati chapter, but other chapters were well represented.

At the first session of the meeting, O. N. Stone, assistant chief engineer of the Van Dorn & Dutton Co., Cleveland, spoke on, "Gearing as a Medium of Industrial Power Transmission." The speaker for the second session held in the afternoon of the first day was R. G. Guthrie, metallurgist of the industrial gas department of the People's Gas Light and Coke Co., Chicago. He took for his subject, "Sample Preparation for High Power Photo-Micrography." At the same session G. W. Quick and S. J. Rosenberg of the Bureau of Standards, Washington gave a paper entitled, "Wear and Wear Testing."

An informal banquet was held on Thursday night with Julian A. Pollak acting as toastmaster and with an address of welcome delivered by Fred A. Geier of the Cincinnati Milling Machine Co. President W. S. Bidle of the A.S.S.T. responded and a technical paper was delivered by R. H. Smith, vice-president of the Lamson & Sessions Co., Kent, Ohio.

Friday was spent in plant visitations, many of the machine tool plants in and around Cincinnati being inspected by the steel treaters.

Commercial Aviation Investigation

That some form of government aid is necessary for the development of commercial aviation was agreed upon by the witnesses that appeared before the Congressional committee investigating the development of commercial aviation as a feeder to military aviation. Sessions were held at the Waldorf Astoria Hotel, New York City, Thursday, Friday and Saturday, Jan. 15, 16 and 17, with Representative Randolph Perkins as chief examiner for the committee.

Many witnesses were called including manufacturers of airplanes and varous airplane equipment, Army and Navy officers detailed to aviation, and others directly or indirectly interested in the development.

That commercial aviation is practical was generally accepted, and that its use would result in the encouragement of better engineering and designing was also agreed upon, but without governmental aid it would not get the proper impetus and fostering, it was stated. Commercial aviation would train flyers to the work and it would be possible to turn commercial ships into combat ships with but few changes.

The investigation is being continued in Washington and other cities with a report expected within a few weeks.

Engineering Council Praised by Hoover

Commerce Secretary Hoover after listening to an appeal for less government spending, voiced by General Lord, the Director of the Budget, at the Annual Dinner of the American Engineering Council, put forward the idea that some of the Federal Government's spending is in the public interest. He pointed out that the reproductive services of the government are adding to the national wealth and make available for taxation hundreds of millions of dollars. He cited as an example his estimate that the expenditure by the Department of Commerce of $100,000 in efforts to eliminate waste in industry had resulted in the saving of $600,000,000.

Content with putting this thought before General Lord and the American Engineering Council, Secretary Hoover brought out forcefully the great good which General Lord is accomplishing and suggested there should be forty-nine of him so each state, in addition, could have a General Lord to supervise its budget.

In expressing the hope that the American Engineering Council may carry on and gain in strength, Secretary Hoover expressed the wish that the reorganization of the Council "will make it possible for some of our engineering brethren to come more amiably into line." "It may be," he continued, "we will have to wait for the death of some of the older members of some of the societies, but we can live in hope and in the meantime we must keep the Council alive. If the institution can produce, not once in five years, but once in fifty years, the beginning of a great national conception in the change of our economic system, such as was produced in five years, (the Elimination of Waste Report) it will warrant its existence and all of the labor which you gentlemen have devoted to it."

Mr. Hoover followed these remarks by an exceptionally clear outline of the work being done to eliminate industrial waste.

New Problems for France to Face

Politics and the influence on industry—Auto makers talking "Saturation Points"—German reparations and competition—The apprentice situation—American machinery buying increases

By Our Paris Correspondent

THE 100 million dollar Morgan loan and the interior four billion franc loan have not immeasurably improved the French business outlook, least of all the momentary situation. Furthermore dollar and sterling exchange still remains at the approximate high figures of the past two months or more. One disrupting influence after another has brought France to the end of the year deadlock facing the prospect of another political crisis and the fall of the Herriot cabinet not far ahead.

At that the French economic and industrial situation should be somewhat improved in that payments in kind from Germany during the first trimestre of the application of the Dawes plan equalled 91,830,904 gold marks, of which coal and coke accounted for 18,922,460 marks; chemical fertilizers, 891,584 marks; coloring matters and dye-stuffs, 1,910,888 marks. Besides this Germany paid in paper marks, but to the value of gold marks, 12,470,066 for the expenses of the army of occupation.

The metallurgical market in its fundamentals has changed but little from its aspect of the past eight weeks. Prices are firm but not impelling for the consumer who would buy for more than daily needs and not over profitable for the producer. The slowing down of the moment gives opportunity for inventory and a sizing up of the New Year's expectations. Both consumer and producer are jockeying for their places.

Watching Germany

Jan. 10 is likely to be a memorable date in the annals of the French metal manufacturing trades. The Franco-German accord which is to go into effect at that time is far from being lined up at this writing, but it would be more a disaster than a crisis if it were not actually completed by the date in question. Siderurgy, metallurgy and the machinery and metal trades in general have every interest to know their fate at the earliest possible moment if they are not to stagnate still longer. Of all the big industries—save possibly that of the chemicals and dyes—that of metallurgy and its allied trades are paramount in this matter. Foreign exchange rates are by no means stranger to this state of affairs, but chiefly it is the uncertainty as to the attitude Germany will take toward French trade at home and in export markets, and vice versa, that is the principal cause of the momentary inquietude.

Production facilities are greater than ever but all co-relative lines are being pushed to their economic limit solely that the expected first of the year competition from abroad may be met the more successfully. As usual the plate and sheet market is more confused than that of any other of the finished products of metallurgy.

It would seem that the automobile industry was coming to accept the conviction that the saturation point in France was being approached rapidly. Credit sales to the consumer are more and more in evidence than ever and for the first time the French industry is offering real service to its customers in the shape of stock replacements and direct representation rather than mere agencies. There is a noted slowing down in the demands for labor in this industry—indeed there has been a laying off of approximately 5 per cent of employees during the past month, which in a certain sense may be considered as seasonable, and again may mean something quite different. The first two months of the year will tell, depending largely upon whether the German automobile industry gets its second wind or not, specifically referring to export markets which France has been approaching so successfully recently.

Moving from Paris

A decentralization movement in this industry seems to be clearly defined in that various important plants are now found in the provinces, having removed from the Paris district. The latest is the project of the Citroën plant to erect a new plant at Chambery in Savoy, urged thereto by the municipality of that progressive city by the offer of exceptional conditions for the supply of electric light and power. Citroën having got more than one good idea from Henry Ford, it may be that he is going in for healthful, bucolic surroundings for his workpeople.

There is a growing interest, if not as yet any great consumption that can be measured, in French-made agricultural tools, implements and machinery. The industry's Chamber of Commerce has seven hundred members;. distributors and dealers mostly, but also including manufacturers, of which there are more than fifty with a capital of from one to ten million francs. For many agricultural machines French constructors claim to be able to more than meet the French demand without imports from abroad. In spite of this when one sees a piece of agricultural machinery on a flat car at a siding or in a freight house it is more than likely to be of American manufacture.

The annual French output is estimated at 6,000 reapers and 3,500 binders, while of the latter (units were not given) 20,000 metric tons were imported in a single year and harvesters to the value of 129,000,000 francs. In spite of this the industry may be said to be a lusty infant. The farmer wants all customs dues taken off agricultural machinery, at least his representatives in parliament do, though it is doubtful if he has the wit to give it a thought, claiming that it would reduce the cost of wheat three cents a bushel and the breakfast table would be the gainer thereby. The argument is about as futile as that of the cost of the workingman's tin dinner pail a generation or more ago, but it serves its political ends just the same. It also calls forth a protest from the manufacturer so the vicious circle begins to outline itself again.

Checking Progress

The subject may appear trifling at a distance, but the fact is that it shows the more or less vague tendencies and ramifications of issues which are continually arising in post-war France and one of the reasons why progress and prosperity are apparently as intermittent as they are, and as difficult to judge as to their real significance. France did export 35 million francs worth of agricultural machinery in 1923, which is a notable progress over what was the state of affairs in 1913, the year before the war.

Eleven months' exports of 1924 exceeded those of 1923 by 4,791,988 metric tons and 10,120,725,000 francs in value. Imports were respectively (in excess of 1923) 2,075,598 tons and in value 7,259,729,000 francs. In every case these figures represent substantial increases over those of 1913, the year before the war. This connotes the remarkable fact that proves that France is less a self-sufficient, self-sustaining country than it was, which may or may not represent a real progress.

Apprenticeship

In spite of the apprenticeship crisis and the recent governmental proposition to establish an apprentice's school to be supported by employing industries, the scheme does not seem to be meeting with encouragement. This is largely because it will impose further taxation upon industry and again because it overlaps another organization working to the same end. In the same connection the *artizinat*—the small shop employers with few employees, precision tool makers and the like—protest against the application of the tax deeming that the schooling that they now give their apprentices is an all-sufficient tax and quite all the load the employer can carry, it being remarked that there is no question of abolishing the daily wage for apprentice hands.

American machinery exports to France have steadily increased during the later months, also to Belgium. The same applies to automobiles and agricultural tools and machinery.

Engineering Council Names Committee to Study Aircraft Situation

Sweeping inquiry into air navigation, says Pres. Hartness

Appointment of a committee to study the whole aircraft situation was announced recently by the American Engineering Council. The chairman is Joseph W. Roe, professor of industrial engineering in New York University.

The committee, it was stated by the President of the Council, Ex-Governor James Hartness of Vermont, plans a sweeping inquiry into all phases of air navigation, particularly air mail, commercial flying, and national defense.

A large group of related questions would, he said, be taken up. The economic and industrial possibilities of aircraft were described as the central problem. The most feasible air routes from an economic standpoint will be sought out, and special studies made of topographic and climatic conditions.

The report of the committee will be submitted to the American Engineering Council, the findings probably serving as a guide to future engineering policy in the field of aeronautics, which, it was pointed out, largely involves engineering problems.

Prof. Roe is a former president of the Society of Industrial Engineers, and came to New York University from the faculty of the Sheffield Scientific School of Yale University. He is a former member of the American Engineering Council, and during the war was stationed at McCook Field, Dayton, Ohio.

Other members of the committee are: Prof. E. P. Warner, Massachusetts Institute of Technology, chairman of the Aeronautics Division of the American Society of Mechanical Engineers; Dr. W. F. Durand, president of the American Society of Mechanical Engineers, professor emeritus in Leland Stanford University, and member of the National Advisory Committee on Aeronautics; George William Lewis, executive officer of the National Advisory Committee on Aeronautics, Washington; Starr Truscott, design expert, Naval Bureau of Aeronautics, Washington; William B. Stout, airplane manufacturer, Detroit; Charles M. Manly, New York; Colonel A. T. Perkins, St. Louis; Howard E. Coffin, Detroit; G. C. Spaulding, Spokane, Wash.

The development of aircraft, more accurate knowledge of which, it was said, is needed both from the standpoint of public service and private enterprise, will be discussed at the annual meeting of the American Engineering Council to be held in Washington.

FULL STEAM AHEAD

"THE HORIZON IS CLEAR. THE BUSINESS BAROMETER SHOWS FINE WEATHER AHEAD. THERE ARE NO CONDITIONS NOW APPARENT TO PREVENT FULL SPEED AHEAD!"
CAPITAL
LABOR
FARMER
U.S.S.
PROSPERITY

—Chicago Daily Tribune.

Czechs May Reduce Machine Tariff

A bill has been introduced before the Czechoslovak parliament proposing the reduction of the duties on industrial machinery of that type that is not competitive with Czechoslovak-made machines, according to a report to the Department of Commerce from Trade Commissioner, H. L. Groves, Prague.

Under the proposed law, which would be effective up to the end of 1926, reductions are provided for on the principal types of industrial apparatus with the exception of textile machinery and certain electrical equipment.

The proposed tariff reductions will be of substantial character, making the duties in some cases as low as one-third of the present duties. The proposed method of reduction is to fix the coefficient at four for all the tariff items affected (that is, the basic tariff is to be multiplied by four to determine the proposed duties in Czechoslovak crowns), in place of the present coefficients which vary from sixteen to twenty-five.

Census of Foundry and Machine Shop Products

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of foundry and machine shop products reported products valued at $2,337,807,997, an increase of 49.3 per cent as compared with 1921, the last preceding census year. Of this amount, $124,691,231 was contributed by boiler shops, $354,708,016 by foundries, $1,280,382,726 by machine shops, and $578,026,024 by machine shops and foundries combined. Of the total reported by foundries ($354,708,016), $37,638,766 was contributed by foundries engaged primarily in the production of steel castings, $117,386,866 by those which reported malleable iron castings as their principal products, $154,928,816 by those making gray iron castings, and $44,753,568 by those whose leading products were other kinds of castings.

The Department of Commerce also announces that the establishments engaged primarily in the manufacture of hand tools, other than edge tools, files, and saws, reported products valued at $123,160,303, an increase of 74.6 per cent as compared with 1921, the last preceding census year. Of this total, $15,841,086 was contributed by establishments engaged primarily in the manufacture of shovels, spades, scoops, and hoes; $8,300,879, by those whose principal products were carpenters' tools; $43,655,553, by manufacturers of machinists' tools; and $55,362,785, by establishments engaged in the manufacture of all other classes of tools.

The Business Barometer

This week's outlet in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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LAST week the stock market had the first real reaction since the election. Most people have been surprised that it was so long in coming and there are but few who think that it indicates high water or a change in the tide.

But Wall Street tides are irregular. There is no almanac by which their rise and fall can be predetermined and even the most acute observers may err egregiously in gaging the force and duration of their flow. It is largely a psychological problem and hardly anything short of a national election will reveal the national psychology in relation to matters economic.

When optimism is widespread, as at present, news that would normally suggest caution is bullishly interpreted and the reverse is true when pessimism is in the saddle. For this deflection of the popular judgment the careful student must make allowance, but he must also realize that it is just as dangerous to be too far ahead of public opinion as to be too far behind it. Therefore it may be a mistake to assume that the easier tone of the stock market is due to the analysis of the member banks' position that was included in the statement of the Federal Reserve Board given to the press for release on January 9.

As to the business revival it can not yet be called general. In so far as the trade in dry goods is concerned one of the largest jobbers in the Middle West sums up conditions in these words: "Business is still far behind sentiment. The picture is pretty, stocks are low, confidence is widespread and hope is in the ascendant, but thus far it has been a hope deferred."

In the East the hopes of the optimists are perhaps a little nearer realization, but cotton goods are still held in check by the fear of a decline in the raw material and woolen fabrics reflect a doubt of whether the ruling price for wool itself can be maintained.

But in some other lines there is definite improvement. This is especially true of shoes and leather. Steel and copper are also well maintained, although the trade authorities report that the demand for the former is not quite so active. Sugar is apparently stabilized around 3 cents for July delivery. Coffee has declined because the trade has become fearful of the statistical chaos that prevails and rubber has been factitiously depressed by London dealers in an effort to avert the increased exports from the plantations that would be permissible under the Stevenson plan if prices went higher and stayed there.

Wheat and corn have been the star performers in the speculative arena. Both have sold at the highest prices of the season and $2.00 has been paid in Chicago for special grades of wheat. The trading narrowed as prices advanced and those who would rather be safe than sorry are now withdrawing from the grain markets. Petroleum and its by-products have been again advanced and cattle and hogs have continued to rise. An "acute shortage" of hog products in 1926 is indicated by a survey issued by the U. S. Department of Agriculture.

Some automobile manufacturers openly admit that the point of saturation has been reached in so far as passenger cars are concerned and a decrease in production during 1925 is generally expected.

The retail trade is quiet, but chain stores and mail order concerns report a large increase in their sales and it may be that the public are trying to economize. Wages in the New England cotton mills have been generally cut by 10 per cent, but some of the weavers in Fall River have struck rather than accept the reduction. Our domestic consumption of cotton in December was 532,000 bales as against 492,000 in 1923 and in view of the comparative idleness of the New England mills it must be inferred that their Southern competitors are profitably busy.

In New York City there seems to be an increase of unemployment. The statement of our foreign trade for December shows merchandise exports that were $109,000,000 in excess of imports. The excess of exports for the calendar year was about $1,000,000,000. Net exports of gold for December were $29,400,000. The indications are that much more will go out in January.

The weekly statement of the Federal Reserve Banks shows no changes worth commenting upon. The reserve ratio stands at 76 per cent as compared with 74.6 at the end of the previous week. The railroad traffic continues large. Bank clearings are well ahead of last year and trade seems to be on an even keel, although no boom is any longer indicated or expected.

What's Doing in Industry

A notable fact that is reported from most sections of the country this week is that the purchasers of machinery and machine tools are general industrials rather than the railroads, the big electric companies or the automobile builders. This is indicative of a more widespread prosperity than if the field were narrowed to one or two groups of buyers. Railroads were in the market to the usual degree for necessities, and in the Detroit district a distinct improvement was noted following a two weeks' lull.

Indirectly affecting the machine tool trade is the news that power plant expansions are more general this year, especially in the East. While central station programs will go forward as usual with here and there larger appropriations, the big improvement will come among the industrial power plants where new equipment is reported to be needed.

Financial reports show the electrical companies to be in excellent condition this year and further improvement is expected. This, of course, means that machinery and tools will find their way into the plants at a rate corresponding to the companies' progress.

There is a divergence of opinion on automobile production. Certainly with the export demand increasing this year and with the domestic demand for replacement at normal, the total output should be as large as that of 1924. The year has started off far better than last year.

French Machine Men Visiting Japan

The Syndicate of French Manufacturers of Machinery and Electrical Equipment is projecting a business pilgrimage to Japan. Delegates will be from among the most important and highly specialized firms only, the expense for the tour being estimated at the equivalent of four thousand dollars. The same association is asking the government for the abolishment of the turnover tax of 1.3 per cent on all export business. This smacks of class distinction, but other classes do benefit from certain relief in taxation so the proposition is not without precedent in France.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

Favorable basic economic conditions continue to prevail in Philadelphia, and on this manufacturers and industrial leaders generally base their hopes for an early revival of substantial business.

Some of the machine tool producers already have experienced a favorable reaction to these conditions, while others express the belief that the situation presents a satisfactory condition.

Announcement by the Reading Co. that it plans an early issue of $8,000,000 in equipment trust certificates was welcome news to the industrial centers. Approval for this issue has been given by the Interstate Commerce Commission. The equipment to be purchased through this issue consists of 25 consolidated type locomotives, 10 Pacific type locomotives, five switching type engines, 120 steel suburban passenger cars, thirty steel combined passenger-baggage cars, ten steel baggage cars, two steel gasoline passenger cars, 274 steel gondola cars, fifty frame stock cars, 1,000 steel hopper coal cars, two steel grain barges, and two steel ferry boats.

The Baldwin Locomotive Works last week shipped twenty locomotives to Brazil, and next week plans the shipment of eight more to the same country. The plants in Philadelphia and in Eddystone, Pa., are operating about thirty per cent of full capacity.

J. G. Brill & Co., car builders, are operating at about forty per cent of capacity. One of their largest activities now is the construction of gasoline driven railway cars for some Southern and Southwestern railroads. These are larger and more powerful than those previously put out by the same concern.

Cleveland

Further improvement in the machine tool situation in the Cleveland district is seen as the first month of the new year is rounded out. General manufacturing is absorbing a larger amount of new equipment in the last few weeks than it has done in any similar period in the last year. In some fields each day sees a little change for the better both as to the quality of equipment wanted and the number of tools taken.

By far the best outlook at the moment is seen in general manufacturing requiring automatic equipment. Both heavy duty and light machines of this variety have been moving with a great deal more speed than has been the case for many months. It is significant, in the minds of leaders among automatic machine interests that new equipment almost exclusively is wanted now.

Marked improvement in the planer division is seen since the beginning of the year. Cleveland manufacturers believe that the biggest improvement in this department will be from Eastern manufacturing interests, as both inquiries and orders have been received from a widely scattered territory in that part of the country. Railroad shops, textile mills and plants that heretofore were not even interested in amplifying their shop facilities now are coming forward.

Prospects for better outlet for punches, shears and similar equipment are not so good, though a consistent drive to bring about buying interest is bringing out more inquiry, if not orders. Manufacturers here are not disturbed by the present lack of demand, however, since this is the accepted quiet period for them.

Southern District

While machine and tool sales in the South were more or less quiet the first week or ten days of the year, dealers advise that inquiries have been more active than ever, and that better than normal sales are looked for the last half of this month. Indications give promise, in fact, that January sales will exceed those of the same month last year, in spite of the fact that early 1924 business was unusually good over the whole of the South.

Inquiries are most active from the railroads for heavier equipment, and for miscellaneous machinery and tools from the service stations and smaller machine shops, and the lumber industries, with fairly good inquiries noted from the textile and road building industries

Textile business gives promise of being better the next few months than it has been in years, while road building sales this year are expected to exceed all past records, as Southern states have announced road building programs this year that are estimated at around $400,000,000, which will serve to make this one of the biggest road construction years in the history of the South. Equipment sales to this source have already opened up, and the trade is looking for it to continue active for an indefinite period.

It is also interesting to note that a a good volume of business has been lately reported to new industrial concerns establishing plants in this district, with indications portending unusual activity of this nature during the next few months. Practically all of the important Southern industries are very active in this regard, and have been for several months, establishing new building records during 1924, and looking for still larger records during the present year.

Considerable business is being reported by the larger second hand and rebuilt machinery dealers in the territory.

Regarded as a whole, the larger dealers state that the outlook for business during the first half of this year is the best it has been in the past half decade.

Milwaukee

The formulation of definite plans by the metalworking industries in Milwaukee and throughout Wisconsin for increased production is following a noticeable upturn in contracts and orders being received by foundries and machine shops since the beginning of the year. The effect this already has produced is to enlarge the working forces of nearly every shop, and while in few cases has it been necessary to bring operations up to full capacity, this development seems to be a possibility during the course of the year.

A healthy demand for machine tools necessarily requires as its forerunner a pressure upon facilities that compels their expansion. Few industries of importance have felt this necessity since 1920, and in fact it was not even remotely suggested. While the state of business at present is far from the point where material enlargement is necessary, save in a few isolated instances, the improvement going on, if sustained, will tax capacity before many more months elapse.

Immediate sales of metalworking equipment therefore consist largely of offsetting replacement needs, both of worn out machines and obsolete equipment. The notable exception is the Nash automobile industry, which is enlarging its Kenosha and Milwaukee works and, what is more important to the trade, is equipping a complete new production center at Racine, in the former Mitchell plant.

With major concerns like the Allis-Chalmers Manufacturing Co. of Milwaukee experiencing an upturn in the new business curve, the hopes of machine tool makers as well as dealers are rising. This concern is developing its electric generating business to take advantage of the brilliant opportunities the public utility business is providing, especially in Wisconsin, where hydro-electric equipment demands are growing larger year after year.

Industrial construction in the Milwaukee territory has been at low ebb for a number of years. Meanwhile there has been a record-breaking pace in the construction of hotels, apartment buildings and dwellings. Signs of a surplus of such facilities have ap-

peared, and the construction industry is gaining confidence that the slackening will shortly be offset by a revival in industrial construction as the business situation improves.

Dealers say they have noticed a slowing down in the demand for used equipment. In light tools, there is a moderate movement to the smaller shops which are obliged to seek economy in cost. Stocks of used equipment are still heavy, but regarded as less uncomfortable than a year ago.

Chicago

Generally speaking, little change is noted in the Chicago machine tool market for the last week. Orders are coming in but slowly, although inquiries show a satisfactory increase in number.

Gear manufacturers report that the City of Milwaukee will shortly be in the market for their products to a considerable extent and are expectantly awaiting a schedule of the city's requirements. The Board of Trustees of the Chicago Sanitary District has just advertised its budget for the year 1925 in the form of a city ordinance to be voted on at the February election. The budget totals in excess of $36,000,000, and in it are included items for machinery, machine shop requirements and tools amounting to $13,350. Details as to these will not be made known until the budget has been approved.

A report just issued by the Illinois Department of Labor shows some increase in industrial activity throughout the state during the last months of 1924. Among the 12 basic groups reviewed, the agricultural implement industry during the last four months showed an increase of 33 per cent in workers, while the machinery industry, which is regarded as a sensitive barometer, reported an increase of 3.8 per cent. Machine tool manufacturers and dealers continue to express optimism as to 1925 business, which will develop in a satisfactory manner within the next few weeks.

Cincinnati

After a short lull caused by the holiday season the machine tool manufacturers in Cincinnati report that the early weeks of 1925 are bringing in an encouraging number of orders. While the business plaeed to date has not been large, it has been of sufficient quantity to warrant plant executives to expect good business during the next few months. The production already is ahead of the initial weeks of 1924 and most manufacturers feel that this year will continue to hold a comfortable lead over last year in operations. One of the hopeful signs is the opening up of buying of small tools with several sizeable orders placed for large lathes and planers.

Railroad buying is inactive at present, but several lines have lists out that will probably close in the next month. It is expected that the railroads will come into the local market to a greater extent this year than in 1924. There has been some improvement in the orders from the automobile manufacturers, but purchases in this field are still made conservatively. Three of the large machine tool houses report that January has been a good month for them as compared with the corresponding month last year.

The production of lathes and milling machines has been fair in the last two weeks. Planer manufacturers report that inquiries are good and several orders have been placed in the past ten days. The demand for drilling machinery is better than it was a few weeks ago with indications of further improvement in the near future. Woodworking machinery concerns are well satisfied with the amount of business that they have booked ahead and their present production is normal. Electrical tool manufacturers say that their volume of sales has been fair lately. The outlook is for good business in the automotive field during this year, according to the executives in charge of electrical tool sales.

The used machinery market is in good shape with considerable call for small tools and single machines. The outlook is for good, steady business in used tools. The Chevrolet assembling plant at Norwood is operating at capacity and its activities are expected to continue uninterruptedly due to the new models just placed on the market.

Detroit

Little change has taken place in the machine tool and machinery fields in Detroit during the past week.

Continued evidences of increased production schedules on the part of the motor car plants in this section of Michigan have served to substantiate the feeling of optimism that apparently permeates most of the larger dealers of machinery here.

With the annual meeting of the Society of Automotive Engineers next week in Detroit in connection with the Detroit Automobile Show, executives of machine tool firms expect developments that will have a material effect upon the industry in Detroit for the coming year.

Inquiries to Detroit firms are more frequent than for some time past, and a large proportion are resulting in sales. Most of the orders are for single machines, but the volume has been up to the standard set through the past three weeks.

One gratifying feature of the year so far has been the improvement in the used tool situation.

New England

In the principal centers of the New England territory, particularly throughout Connecticut, heads of manufacturing industries are giving attention to a study of the business records for the fiscal year closed or closing. In this connection the year's records as a whole are up for analysis and generally speaking, there is a better feeling. In not a few instances the balance sheets show a better profit than was expected.

A manufacturer of automatic machinery said that the automobile industry, judged from his experience, is now in a good buying mood. The bulk of the orders of this company are for plant expansions, if the business has been correctly interpreted. The expansion business even exceeded in volume the replacement business. There is in prospect a substantial amount of new contract business upon which several firms have been invited to bid. Orders for deliveries on contracts in effect have been greater.

Manufacturers of machinery also report a better volume of business for export and an expansion of inquiries.

Small tool manufacturers and makers of tradesmen's tools also report an increasing demand.

New York

General industries are the buyers of machinery and machine tools in the New York district, according to dealers and the volume of business for the first three weeks of January is estimated as the largest done in a similar period in more than eighteen months. One dealer stated that his business for January would be the best in his ten years of business existence and that he expected February to be even better. He based his optimism on the unusual number of inquiries and the rapidity with which salesmen were closing deals.

During the past year general industries did not do much buying, especially during the last six months of the year, hence the rush of orders now when it is generally considered that good business is ahead. Orders are mostly for single machines with here and there orders for groups, but there are so many of them that dealers feel satisfied and hopeful that the business will be spread over a long period of time.

Railroads are also in the market this month, but not to any marked degree. Car builders and locomotive manufacturers were both in the market with inquiries and purchases last week.

Eastern automobile makers were also buying tools and the business from this source is expected to increase as the year progresses.

Personals

ARTHUR C. HOEFINGHOFF has resigned from the Cincinnati Grinder Co., Cincinnati, Ohio, effective Dec. 31.

J. K. COURIM, formerly at the Indianapolis Office of the Black & Decker Manufacturing Co., Towson, Md. has been made manager of the St. Louis office. His headquarters will be at 2839 Locust St.

WILLIAM J. ELBERLIEN, formerly with the Greenfield Tap & Die Corporation, Greenfield, Mass., has been appointed district manager of the Williams Tool Corporation at its Chicago branch office, 549 W. Washington Boulevard.

G. V. BELLOWS has been made manager of maintenance at the Lansing, Mich., plant of the Auto Body Co. He succeeds ARTHUR H. LEONARD, resigned.

PAUL E. LUTHER, formerly president of the Springfield Brass & Iron Foundry of Springfield, Vt., is now with the Salamanca Foundry & Machine Works, Salamanca, N. Y.

R. W. SOMERVILLE has been appointed manager of the Toronto branch of the Black & Decker Co., Towson, Md. His headquarters will be at 52 Dundas St., Toronto, Canada.

PAUL W. HILLER has been placed in charge of the advertising department of the Carbondale Machine Co., Carbondale, Pa.

EARLE H. RUSSELL, treasurer of the Noiseless Typewriter Co. at Middletown, Conn., and JOSEPH MERRIMAN, also of Middletown, retire with the merger of this company with the Remington-Noiseless Typewriter Co.

WILLIAM M. GREENE, formerly with the Automatic Refrigerator Co., Hartford, Conn., has severed his connection to become associated with the Salamanca Foundry & Machine Works, Salamanca, N. Y.

JAMES F. HAMILTON, for ten years in the engineering and sales department of the Cudahy works of the Worthington Pump & Machinery Corporation, Cudahy, Wis., which operation was abandoned July 1, 1924, has returned after spending six months at the Worthington works in Harrison, N. J., to open a sales office for the entire Worthington line. This has been established at 895 South Pierce Street, Milwaukee.

L. E. BERRY has been appointed manager of the Dallas branch of the Black & Decker Co., Towson, Md.

C. MOODY, formerly manager of the Auto Lite Gas Co., Winnipeg, Canada, has joined the apparatus factory organization of the Purox Co. at Los Angeles, Calif.

T. H. BELLING has been made manager of the Minneapolis branch of the Black & Decker Manufacturing Co., Towson, Md. His headquarters will be at 518 South 4th Street.

O. P. HANCHETTE, *a welding* engineer, has been added to the staff of the Burke Electric Co., Erie Pa., Mr. Hanchette will be connected with the Cleveland office at 7820 Euclid Ave., Cleveland.

LEO C. GEHRING has been transferred from the Minneapolis to the Buffalo office of the Black & Decker Co., Towson, Md. His headquarters are at 31 Barker St.

B. FRANKLIN CONNER has been appointed sales manager of the Johns-Pratt Co., Hartford, Conn. He was formerly with the Auburn Button Works, Auburn, N. Y.

WILLIAM H. LUCAS, JR., for the past 21 years chief engineer and factory superintendent of the Espen-Lucas Machine Works, Philadelphia, Pa., has been appointed factory and production manager of the Delling Motors Co., West Collingswood, N. J.

O. L. CHAPMAN has joined the sales organization of the Scott Valve Manufacturing Co., Detroit.

E. S. MARKS has been appointed chief engineer of the H. H. Franklin Manufacturing Co. of Syracuse, N. Y. after serving as assistant designing engineer for the company during the last four years.

DR. B. D. SAKLATWALLA has been appointed vice-president of the Vanadium Corporation and of the United States Ferro Alloys Corporation. He was formerly general superintendent of the Bridgeville plant of the Vanadium Corporation.

JAMES S. O'ROURKE has been made vice-president in charge of sales of the Murray Body Corporation of Detroit, the new concern formed by the consolidation of the C. R. Wilson Body Co., Towson Body Co, and J. C. Widman & Co., all of Detroit. Previous to his connection with the Murray Body Corporation, Mr. O'Rourke was general sales manager of the J. W. Murray Manufacturing Co.

Obituaries

JOSEPH E. BLAKESLY, Southern district manager for the Columbia Heating & Blowpipe Co. with headquarters in Atlanta, died at his home in that city recently at the age of 35 years.

RICHARD MOON, aged 60 years, died recently at his home in Homestead, Pa. He had been superintendent of the mechanical department of the Homestead Steel Works for many years.

A. S. WINCHESTER, aged 87 years, died recently in New London. Mr. Winchester was formerly connected with the Lee Arms Co., the Sharp Rifle Co., and the Smith & Winchester Manufacturing Corporation.

Business Items

The Kent Machine Co., Kent, Ohio, has purchased from the National Acme Co., Cleveland, Ohio, all drawings, patterns and tools for manufacturing and also all rights to manufacture under patents the complete line of "Namco" auxiliary machinery that has been made by the National Acme Co. for the past few years.

The Meldrum-Gabrielson Co., Syracuse, N. Y., the Tomlin Harris Co., Cordele, Ga., the Cowan Truck Co., Holyoke, Mass., and the Wassau Abrasive Co., Wassau, Wis., have recently appointed the Kemp Machinery Co. Baltimore, as their agent for Maryland, Virginia and the District of Columbia.

The Knoxville Engineering Equipment & Supply Co., Knoxville, Tenn., distributor of machinery and supplies to engineers and contractors in the Southeastern territory, announces the removal of the firm from 200 National Building to 11 Journal Building.

The Thomas Machinery Co., Los Angeles, Calif., will be the distributor in southern California for the Foote Bros. Gear & Machine Co., Chicago, Ill.

The Contractors Supply Co. has been incorporated at Miami, Fla., with $100,000 capital to distribute machinery and equipment to the contracting field. Charles L. Pettit, of Miami, is named to the presidency of the firm, and P. G. Prevatt, 1542 North Bayshore Drive, Miami, secretary.

The F. Somers Peterson Co., San Francisco, Calif., will be the distributor in northern California for the Foote Bros. Gear & Machine Co., Chicago, Ill.

The Meriden-Foster-Merriam Co., of Meriden, Conn., has filed a preliminary certificate of incorporation at the office of the state secretary. The company is to engage in the general foundry business with a capital of $175,000. Howard E. Boardman, Charles W. Merrill and Albert W. Savage are the incorporators. This is part of the plan of the reorganization of the Foster-Merriam & Co.

The American Casting Co., Birmingham, Ala., has announced an increase in the capital stock from $50,000 to $250,000, and plans for expanding the facilities of the plant during the present year.

The Harper Manufacturing Co., Inc., Hartford, Conn., filed a preliminary certificate of incorporation at the office of the state secretary. The capitalization of the new corporation is $300,000. The company is to engage in the machinery industry. Theodore Lilley, William M. Goss, and Theodore B. Harper, are the incorporators.

The Karvan Co., Inc., New London, Conn., has filed a preliminary certificate of incorporation at the office of the state secretary. Its objects are to engage in the manufacture and sale of machinery and tools. The company's capital is $50,000. The incorporators are Philip Z. Hankey, John F. Sullivan and Ellam M. B. Getchell, all of New London.

The U. S. Tool Co., Inc., Newark, N. J,. has purchased the plant of the General Electric Co. located at Ampere, New Jersey.

The Walcott Lathe Co., Jackson, Mich., has purchased the grinder patterns and all rights of the American Grinder Co., Detroit, Mich., and the product in the future will be known as the Walcott gear tooth grinder.

Forthcoming Meetings

American Management Association. Annual Convention. Hotel Astor, New York City, Jan. 28, 29 and 30. Headquarters, 20 Vesey St., New York City.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19 C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Most of the current pig iron sales running to small tonnage lots; scarcity of material for immediate shipment. Growing firmness in scrap. Gradual upward trend in steel prices continues. Firmness especially marked in steel bars and plates. Current quotations at Pittsburgh mills are; bars, $2.10; plates and shapes, $2@$2.10 per 100 lb. The lower figure applies on exceptional tonnages.

Non-Ferrous Metals—Copper up ½c. and lead ¼c.; tin down 2c. and zinc, ½c. per lb. in New York warehouses since Jan. 2. Recent advances in pig metal reflected in higher prices for fabricated brass and copper products, zinc sheets, solder, babbitt metal, etc.

Miscellaneous Supplies—Improvement in textile mill situation has resulted in advance of 1c. per lb. in waste and wiping cloths. Linseed and lard cutting oil also tending upward.

(All prices as of Jan. 16)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.25
BIRMINGHAM	
No. 2 Foundry	20.00@20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70	3.89	3.45	3.80
No. 12	2.80	3.94	3.50	3.85
No. 14	2.90	3.99	3.55	3.95
No. 16	3.10	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.45	4.40	4.15	4.30
Nos. 22 and 24	3.50	4.45	4.20	4.35
Nos. 25 and 26	3.55	4.50	4.25	4.40
No. 28	3.60	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75	4.60	....	4.50
Nos. 12 and 14	3.85	4.70	....	4.60
Nos. 16	4.00	....	....	....
Nos. 17 and 21	4.15	5.00	....	4.90
Nos. 22 and 24	4.30	5.15	3.00	5.05
No. 26	4.45	5.30	4.15	5.20
No. 28	4.75	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	56%	43%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¾c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.75
Tin, 5-ton lots, New York			58.50
Lead (up to carlots), St. Louis	10.50	New York	11.25
Zinc (up to carlots), St. Louis	7.90	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00	21.00	16.25
Copper sheets, base	22.75	23.00	22.12½
Copper wire, base	20.62½	21.62½	20.75
Copper bars, base	22.00	23.50	22.62½
Copper tubing, base	25.00	25.62½	25.75
Brass sheets, base	19.37½	20.00	19.25
Brass tubing, base	24.00	25.75	25.00
Brass rods, base	17.37½	19.12½	18.37½
Brass wire, base	19.87½	21.00	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	11.75	12.25	11.37
Solder (½ and ½), (case lots)	.42½@.43½	35.00	.....
Babbitt metal (83% tin)	60.00	69.75	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.75@13.00	12.75	12.00
Copper, heavy, and wire	12.50@12.75	12.50	11.50@11.75
Copper, light, and bottoms	10.75@11.00	11.00	10.50
Heavy lead	8.00@8.25	8.00	8.00
Tea lead	7.00@7.25	6.50	6.75
Brass, heavy, yellow	7.75@8.00	8.00	8.00@8.25
Brass, heavy, red	9.75@10.00	10.00	9.75
Brass, light	6.50@6.75	7.00	6.75
No. 1 yellow rod turnings	8.25@8.50	8.00	8.00
Zinc	4.50@4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade: IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade: IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@.15½	.18	.09½@.12½
Wiping cloths, 13½x13½, per lb	12.00*	36.00 per M	.11
Wiping cloths, 13½x20½, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.18	1.33	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	60%
Second grade	50–10%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0405	.044
Brass rods	per lb	.1737½	.1637½	.15
Solder (½ and ½)	per lb.	.42½@.43½	.40@.41	.3475
Cotton waste	per lb.	.15@.22	.14@.21	11@14
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.60	.55	.55
Machine oil	per gal.	.29	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.75@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@5.75
White lead, dry or in oil	100 lb. kegs		New York, 16.75
Red lead, dry	100 lb. kegs		New York, 16.75
Red lead, in oil	100 lb. kegs		New York, 18.25

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ¾-in., ⅞-in., 1x2-in. to 5-in., per 100 lb.	$3.75	$3.50	$3.50
Cone heads, ditto	3.85	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	6.50*	4.00	3.75
⅝-in., per 100 lb.	5.50*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¾x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1⅛ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¾x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{1}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ¾x¾-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ½-in. and larger.
Case hardened ¾x¾-in., 6c. each, less 50%.

Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ia., Tipton—Bd. of Educ., C. S. Miller, Secy.—bids Jan. 27, for manual training machinery, for new school.

Mass., New Bedford—F. J. Greene, c/o L. L. Labrode, Archt., 502 Olympia Block, garage equipment.

Mich., Detroit—Renaud Boat Works, 161 Cedarhurst St.—20 in. or 24 in. band saw and equipment (used).

O., Cleveland—The Ohio Hammer Piston Ring Co., 2401 Superior Ave.—reaming and cutter grinder.

O., Winton Place (Cincinnati P. O.) M. B. Farrin Lumber Co., L. B. Farrin, Pres.—wood working equipment, for addition to mill, including 2 cut-off saws, 1 molding machine, 2 combination machines.

Pa., Philadelphia—The Haines, Jones, & Codbury Co.,—36 in., squaring shears.

Wis., Shawano—Fritz & Felz—30-in. band saw, 1 shaper, and 1 moulder.

Wis., Wisconsin Rapids—Huntington Garage, Baker Sts.—repair shop machinery, including lathe and emery grinder.

Ont., St. George—Williams & Mitten—garage equipment, etc., for new public garage.

Ont., Toronto—American Radiator Co., Dominion Bank Bldg.—lathes, drills, motors, planes, etc., for machine shop.

Opportunities for Future Business

Ala., Gadsden—The A & J Manufacturing Co. (stoves and accessories), plans the construction of a large addition to the foundry department, on Locust St., increasing the output approximately 50 per cent.

Calif., Alhambra — California Metal Enameling Co., 2155 East 51st St., Los Angeles, have purchased an 8-acre site, and plans the construction of a stove and refrigerator foundry building.

Calif., Los Angeles—Angeles Furniture Mfg. Co., 931 East Pico St., plans the construction of a 3 story, 100 x 600 ft. furniture factory, on 9th St.

Calif., Los Angeles—The Liberty Auto Co., 230 West Washington St., manufacturers of auto tops, seats, wheels, radiators, bodies, etc., is having plans prepared by J. M. Cooper, Marsh-Strong Bldg., for the construction of a 1 story, 70 x 330 ft. factory and shop on Washington St.

Calif., Los Angeles—McClellan Mfg. Co., 951 South Los Angeles St., awarded the contract for the construction of a 1 story, 50 x 100 ft. and 1 story, 200 x 235 ft. furniture factory on South Park Ave.

Calif., Los Angeles—P. R. Meyer, c/o Morgan, Walls & Clements, Van Nuys Bldg., Archts., is receiving bids for the construction of a 1 and 2 story, 200 x 200 ft. garage, store and office building, at Western Ave., and Sierra Vista St.

Calif., Oakland—Mercantile Box Co., 320 Market St., San Francisco, is having plans prepared for the construction of a 1 story, factory on Tidewater St. Estimated cost $16,500. Private plans.

Calif., Oakland—Miller Auto Bed Co., 1102 East 12th St., is having plans prepared by L. F. Hyde, 372 Hanover St., for the construction of a 1 story annex to shop on 40th Ave. Estimated cost $40,000.

Calif., Richmond — The City, c/o A. Faris, Clk., awarded contract for the construction of machine shops. $5,689.

Calif., San Bernardino—The State Highway Comm., Forum Bldg., Sacramento, will take bids until Feb. 2, for the construction of 1 story, 60 x 140 ft. maintenance shop and truck shed. R. M. Morton, State Highway Engr.

Calif., Santa Barbara—Masterbuilt Wall Fixture Co., c/o C. H. Boyd, Santa Barbara Lumber Co., recently organized, plans the construction of a factory for the manufacture of house fixtures. Estimated cost $40,000.

Calif., San Diego — San Diego Electric Railway Co. is having plans prepared for the construction of machine shop, paint and carpenter shops, etc., also a number of storehouses at 14th and K Sts. E. M. Hoffman, Spreckles Bldg., Archt.

Calif., San Francisco—White Truck Co., 1490 Market St., will receive bids in about 10 days for the construction of a 1 story and basement, factory on 11th and Mission Sts. Estimated cost $40,000. H. H. Gutterson, 526 Powell St., Archt.

Ill., East St. Louis—Wescott Valve Co., Seneca Falls, awarded contract for the construction of a 1 and 2 story, various sizes, valve manufacturing plant and foundry, etc. Estimated cost $200,000.

Ia., Sioux City—Albertson Co., 3100 Floyd Ave., having plans prepared by Colby & Westerlind, 108 War Eagle Bldg., Archts., for the construction of a 2 story, 150 x 165 ft., addition to machine shop. Estimated cost $50,000.

La., Gentilly—The Louisville and Nashville R.R. Co., awarded the contract for yard improvements, including the construction of a 63 x 68 ft. machine shop.

Mass., Boston—State Street Garage, Inc., c/o S. S. Eisenberg, 46 Cornhill St., Archt., is receiving bids for the construction of a 6 story 80 x 100 ft. garage at 200 Cambridge St. Estimated cost $250,000.

Mass., Brookline (Boston P. O.)—G. W. Bunnell, 56 Winchester St., plans the construction of a 2 story or more, garage at 585 Newbury St. Estimated cost $200,000. Engineer and architect not selected.

Mass., Cambridge — J. J. Shine, 1374 Massachusetts Ave., will build a 1 and 2 story garage and repair shop, at 410-438 Green St., by day labor. L. Gustin, 1374 Massachusetts Ave., Archt. Estimated cost $159,000.

Mass., Chelsea—F. A. Glaser, 152 Pearl St., having plans prepared by S. Eisenberg, 46 Cornhill, Boston, Archt., for a 1 story 120 x 140 ft., repair and service garage, on Pearl St. Estimated cost $75,000.

Mass., Dorchester — M. A. Berman, 22 Fayban St., awarded contract for construction of a garage at 99 Blue Hill Ave. Estimated cost $150,000.

Mass., New Bedford—F. J. Greene, c/o L. L. Labrode, Archt., 502 Olympia Block, soon awards the contract for the construction of a 2 story, 120 x 140 ft. garage on Elm St. Estimated cost $150,000.

Mich., River Rouge — Ford Motor Co., Highland Park, Mich., plans the construction of a 1 and 2 story, 140 x 400 ft. soaking pit building, for steel plant.

Mo., St. Louis—Scullin Steel Co., 6700 Manchester Ave., awarded the contract for the construction of a 2 story, 60 x 60 ft. addition to steel plant on Manchester Ave. Estimated cost $25,000.

N. Y., Buffalo—R. Potter, 268 Main St., has awarded contract for the construction of a garage and office building, on Main St., to exceed $500,000.

N. C., Robbinsville—H. C. Bemis Lumber Co., Pittsburgh, Pa., is making plans for the construction of a lumber mill, here. Estimated cost $100,000.

O., Canton—The United Alloy Steel Corporation, plans the construction of 5 factory buildings to replace those destroyed by fire; 50 x 300 ft., black sheet mill building, 75 x 300 ft., metal lumber building, 50 x 200 ft., galvanizing building, 25 x 550 ft., truck runway building, and 25 x 80 ft., shop. Estimated cost $150,000 to $200,000.

O., Cleveland—MacDonald Mfg. Co., (press registers) M. MacDonald, Pres., 5015 Wellesley Ave., had plans prepared for the construction of a 1 story, 38 x 60 ft., addition to factory. Estimated cost $40,000. Private plans.

Ohio, Cleveland—The Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., (electric motors) have awarded the contract for the construction of a 1 and 2 story factory, 1080 Ivanhoe Rd. Estimated cost $50,000.

O., Cleveland — The Bryant Heater & Mfg. Co., 952 East 72nd St., O. Fox, Pres., is having preliminary plans prepared for the construction of a 1 and 2 story plant at East 179th St. and St. Claire Ave. Estimated cost $200,000. G. Fox, c/o Owner, Archt.

O., Cleveland — Huron-Ninth-Prospect Co., c/o J. J. Klein, Engineers Bldg., having plans prepared for the construction of a 4 story garage, commercial and office building, at Huron Rd. and East 9th Sts. W. S. Longee, 500 Marshall Bldg., Archt. Estimated cost $350,000.

O., Cleveland — J. Kinsner & Son Co., 8710 Blaine Ave., J. Kinsner, Pres., sheet metal and hot air furnace installers, is having plans prepared for the construction of a 1 story, 100 x 200 ft. factory and warehouse at West 114th St. Estimated cost $60,000. K. I. Best and E. G. Hoefler, B. F. Keith Bldg., Archts.

O., Columbus—R. Wheaton, Columbia Ave., having sketches prepared by O. Dart, 186 East Broad St., Archt., for a 4 story, 76 x 187 ft. garage, at Oak and Front Sts. Estimated cost $425,000.

O., Defiance—The Page Organ Co., c/o O. M. Samson, awarded contract for the construction of a 1 story 23 x 133 factory. Estimated cost $40,000.

Pa., Carlisle — H. C. Masland & Sons, Inc., will soon award the contract for the construction of a 2 story, 81 x 190, 60 x 109 ft., roller storage and machine shop. Lockwood Greene Co., 100 East 42 St., New York, Engrs.

Pa., Pittsburgh—The Pittsburgh Transformer Co., Columbus and Preble Sts., awarded contract for the construction of a 1 story, 120 x 600 ft., transformer manufacturing building. Estimated cost $165,000.

Pa., Punxsutawney—The School Bd. plans the construction of a 3 story, 100x200 ft. school, including manual training shops. Estimated cost $300,000. Architect not selected.

R. I., Providence—A. Zura, c/o B. S. D. Martin, Archt., 86 Weybosset St., awarded the contract for the construction of a 2 story and basement, 138x146 ft. garage at Park and Beech Sts Estimated cost $150,000.

Tex., Fort Worth—Missouri, Kansas and Texas R.R. plans to enlarge yards and construct roundhouse, etc. Estimated cost $1,000,000. K. H. Hanger, c/o Owner, Engr. M. W., F. Ringer, St. Louis, Mo., Ch. Engr.

Wash., Seattle—The Pullman Co., 79 East Adams St., Chicago, Ill., has acquired a 22 acre site for the construction of a plant for the rebuilding and reconditioning of passenger cars, here. Estimated cost $750,000.

Ont., London—Cunningham Furnace & Machinery Co., 1 York St., manufacturers of electric, gas and oil ovens, etc., plans to remodel its plant here and open a branch in Port Huron, Michigan. R. H. Cunningham, Pres. Prices wanted on equipment.

Ont., Owen Sound—Northern Bolt Screw & Wire Co., plans to rebuild nail and wire plants damaged by fire, loss $75,000. Prices wanted on machinery and equipment.